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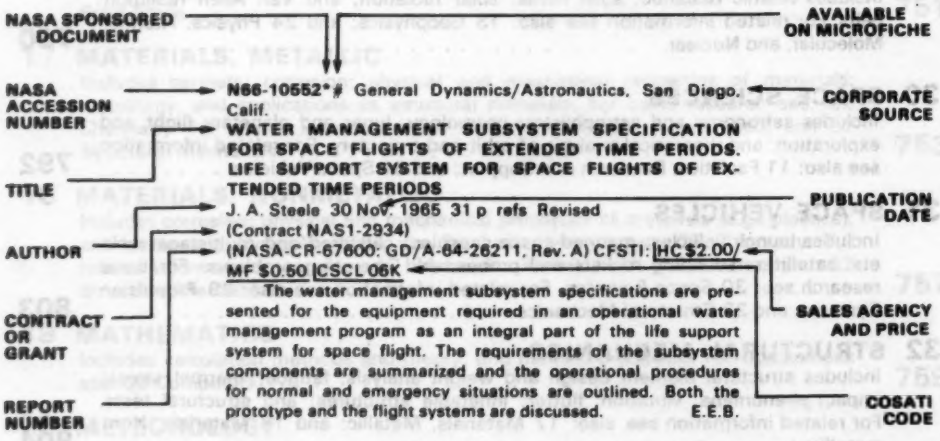
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N66-10552*# General Dynamics/Astronautics, San Diego, Calif.
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TITLE
WATER MANAGEMENT SUBSYSTEM SPECIFICATION FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS. LIFE SUPPORT SYSTEM FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS
PUBLICATION DATE
J. A. Steele 30 Nov. 1965 31 p refs Revised
AUTHOR
(Contract NAS1-2934)
(NASA-CR-67600: GD/A-64-26211, Rev. A) CFSTI: HC $2.00/MF $0.50 CSCL 06K
SALES AGENCY AND PRICE
CONTRACT OR GRANT
The water management subsystem specifications are presented for the equipment required in an operational water management program as an integral part of the life support system for space flight. The requirements of the subsystem components are summarized and the operational procedures for normal and emergency situations are outlined. Both the prototype and the flight systems are discussed. E.E.B.
REPORT NUMBER
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VOLUME 4 NUMBER 5

Scientific and Technical Aerospace Reports

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March 8, 1966

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N66-14326# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CALCULATION OF THE DISTRIBUTION OF STEAM PARAMETERS IN A TURBINE STAGE WITH AN ALLOWANCE FOR RADIAL ACCELERATION

M. Ye. Lavina, P. A. Romanenko, and Yu. V. Grechanichenko 10 Aug. 1965 16 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), v. 10, no. 7, 1964 p 41–45 (FTD-TT-65-1029/1+2; AD-620807) CFSTI: HC $1.00/MF $0.50

A method for calculating the distribution of flow parameters in a turbine stage with cylindrical flow outlines is presented and the results of calculating several stage variants are compared with experimental data. Author (TAB)

N66-14336# Aeronautical Research Council (Gt. Brit.)

AN EXPERIMENTAL HIGH-TEMPERATURE TURBINE (NO. 126)

D. E. Fray and J. F. Barnes London, HMSO, 1965 49 p refs (ARC-R&M-3405) HMSO: £1

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2. PART II: THE EFFECTS OF COOLING ON THE AERODYNAMIC PERFORMANCE J. F. Barnes and D. E. Fray p 28–48 refs (See N66-14338 05-01)

N66-14338 Aeronautical Research Council (Gt. Brit.)

PART II: THE EFFECTS OF COOLING ON THE AERODYNAMIC PERFORMANCE

D. E. Fray and J. F. Barnes *In its* An Exptl. High-Temp. Turbine 1965 p 28–48 refs (See N66-14336 05-01) Supersedes NGTE-R. 250; ARC-24566 (NGTE-R-250; ARC-24566) HMSO: £1

This report describes tests conducted on an experimental high-temperature turbine to measure the effects on aerodynamic performance of discharging cooling air into the main gas stream. The test results show the individual and combined effects on turbine isentropic efficiency of cooling-air discharge from each blade, from parts of the turbine annulus walls, from the rotor and nozzle shrouds and from the upstream face of the rotor disc. Analysis of the test results has shown that the tip clearance losses associated with the unshrouded rotor blades in this turbine can be reduced to some extent when cooling air is discharged from the tips of the blades. Predictions based on a theoretical method, which allows for the changes in flow Mach number and angle and for the losses of total pressure and temperature due to mixing cooling air with the main gas stream, are in reasonable agreement with the observed efficiencies. Author

N66-14382*# National Aeronautics and Space Administration, Washington, D. C.

SOLUTION OF THE EQUATION OF VERTICAL FLIGHT OF A ROCKET BY THE GRAPHIC-MATHEMATICAL METHOD [SOLUCION DE LA ECUACION DE VUELO VERTICAL DE UN COHETE POR EL METODO "GRAFICO-MATHEMATICO"]

Porfierio Becerril Dec. 1965 33 p Transl. into ENGLISH from Congreso Panamericano de Ingenieria Mecanica y Electrica (Mexico), 1965 (NASA-TT-F-9834) CFSTI: HC $2.00/MF $0.50 CSCL 01A

To determine the flight characteristics of SCT-1 and SCT-2 rockets in the atmosphere, a graphical-mathematical solution to the differential flight equation within finite boundaries is presented. Only the rocket's vertical motion in the atmosphere is considered. Newton's laws are used as the basis of the study. The various forces affecting the rocket's flight, including the propelling force, gravitational force, and drag, are discussed. The aerodynamics of the rocket's vertical flight is analyzed both with and without drag. R.N.A.

N66-14628*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

TEST OF A NASA BLUNT BODY WITH FLARES IN THE JPL 20-INCH SUPERSONIC AND 21-INCH HYPERSONIC WIND TUNNELS

Robert W. Weaver 17 Feb. 1963 30 p refs (Contract NAS7-100) (NASA-CR-69129; WT-21-115) CFSTI: HC $2.00/MF $0.50 CSCL 01A

The aerodynamic effects of flares mounted on a blunt body were measured for Mach 2.81, 4.54, and 6.00; at Reynolds numbers from 0.013 × 10^6 to 0.347 × 10^6; angle of attack from 0° to 30° and 180° to 210°; flare angles of 30° and 45°, and for flare diameters of 4.5 and 5.0 inches at two flare locations. The model configuration consisted of a blunted 10° cone with a conical afterbody having a 100° apex angle. Forces and moments were obtained for the complete model. The results reduced to dimensionless coefficients are tabulated. E.E.B.

N66-14670# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.

UNSTATIONARY MEASUREMENTS BY FREE OSCILLATIONS [MESURES INSTATIONNAIRES PAR OSCILLATION LIBRES]

Curt Broll [1965] 32 p refs In FRENCH Presented at the Applied Aerodyn. Meeting of A.F.I.T.A.E., Toulouse, 8–9 Nov. 1965
(TP-289(1965)) CFSTI: HC $2.00/MF $0.50

The method of free oscillations permits direct and concise calculation of nonequilibrium aerodynamic coefficients. Since the time needed for a measurement is equal to the duration of a free oscillation, the method is suited to experiments of short duration, such as those executed at the core of a burst of shock waves. Some experimental setups with flexible models, which are large in proportion to the form of the shock wave, are utilized for this test. The method for free oscillations likewise permits the determination of nonlinear system parameters from linear system experimental results. In the case of nonlinearity, the method of analysis is founded on the simultaneous solution of two curves deduced from the measurements made during the experiment; one curve gives the amplitude modulation, and the other gives the frequency as a function of amplitude. Two examples illustrate the analysis of free oscillations of a second order system, including the nonlinearities met with in the experiment. Transl. by D.T.

N66-14716# Wisconsin Univ., Madison. Mathematics Research Center.
NONUNIFORM STEADY FLOW OF AN IDEAL FLUID PAST AIRFOILS. PART III: NUMERICAL RESULTS
J. Weissinger Jul. 1965 39 p refs
(Contract DA-11-022-ORD-2059)
(MRC-571; AD-623740) CFSTI: HC $2.00/MF $0.50

In Parts I and II theories for nonuniform flow of an exponential type past airfoils have been derived. In this part a further improvement to the approximate theory of Part II is developed. The velocity distribution at elliptical profiles of relative thickness 0.1 and 0.2 has been computed for angles of attack in the range $0 \leq \sin \alpha \leq 0.3$ and is shown in tables in such a way that the accuracy of the methods can easily be compared. Author

N66-14727# Toronto Univ. (Ontario).
AERODYNAMICS OF A RECTANGULAR WING WITH A PERIPHERAL JET FOR AIR CUSHION TAKE-OFF AND LANDING Technical Report, May 1958–Sep. 1964
K. Dau, B. Etkin, and D. Surry Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Sep. 1965 60 p refs
(Contract AF 33(657)-8451)
(AFFDL-TR-65-59; AD-623827) CFSTI: HC $3.00/MF $0.50

Subsonic wind tunnel experiments on a GETOL wing are reported. The main results relevant to performance, stability and control are presented, and applied to a hypothetical vehicle. Short-field capability is demonstrated to be possible, stability and control problems are analyzed, and shown not to be prohibitive. Author (TAB)

N66-14755*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC DAMPING AND OSCILLATORY STABILITY IN PITCH FOR A MODEL OF A TYPICAL SUBSONIC JET-TRANSPORT AIRPLANE
Bruce R. Wright and Margaret L. Brower Washington, NASA, Jan. 1966 16 p refs
(NASA-TN-D-3159) CFSTI: HC $1.00/MF $0.50 CSCL 01A

Wind-tunnel measurements were made in a transonic pressure tunnel at Mach numbers from 0.20 to 0.94 to determine the aerodynamic damping and oscillatory stability in pitch for a model of a typical swept-wing subsonic jet-transport airplane. Tests were made at angles of attack from about −6° to 18° and at Reynolds numbers, based on the mean aerodynamic chord of the wing, from about 0.6×10^6 to about 1.8×10^6. Tests were made at an oscillation amplitude of 1° by using a forced-oscillation technique. The reduced-frequency parameter varied from 0.0026 to 0.0301. Aerodynamic damping was positive throughout the Mach number and angle-of-attack ranges except for negative damping at angles of attack greater than 15° at Mach numbers from 0.20 to 0.60. The sting, which entered the bottom of the model at an angle of 10° with respect to the model reference line, may have influenced the flow on the tail surfaces at the higher angles of attack. Negative values of the oscillatory-longitudinal-stability parameter were present except at a Mach number of 0.60 at an angle of attack of 6° and at Mach numbers of 0.90 and 0.94 near an angle of attack of 9°. The sting entering the bottom of the model may also have influenced the oscillatory-longitudinal-stability parameter at the higher angles of attack. Author

N66-14756*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXPERIMENTAL STABILITY AND DRAG OF A POINTED AND A BLUNTED 30° HALF-ANGLE CONE AT MACH NUMBERS FROM 11.5 TO 34 IN AIR
Peter F. Intrieri Washington, NASA, Jan. 1966 32 p refs
(NASA-TN-D-3193) CFSTI: HC $2.00/MF $0.50 CSCL 01A

An experimental study has been conducted of the static and dynamic stability and drag characteristics of a pointed and a spherically blunted 30° half-angle cone in air at velocities corresponding to Mach numbers of 11.5, 19.5, and 34, and at Reynolds numbers from about 80000 to 170000. For center-of-gravity locations representative of solid homogeneous models, both configurations were statically stable at all Mach numbers throughout the angle-of-attack range of the investigation. The static stability of the pointed cone increased somewhat with increasing Mach number. The static stability of the blunted cone was essentially invariant with Mach number and greater than that of the pointed cone by as much as 40%. The static stability of both configurations decreased with increasing angle of attack. The drag coefficient of both configurations increased with increasing angle of attack and remained essentially constant with increasing Mach number. The drag of the blunted cone was approximately 80% greater than that of the pointed cone. Author

N66-14762*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A THEORETICAL AND EXPERIMENTAL STUDY OF HYPERSONIC FLOW OVER FLARED BODIES AT INCIDENCE
John V. Rakich and Gene P. Menees Washington, NASA, Jan. 1966 50 p refs
(NASA-TN-D-3218) CFSTI: HC $2.00/MF $0.50 CSCL 01A

The inviscid flow over flared bodies at angle of attack is investigated. Experimental pressure distributions are presented for bodies with a hemispherical nose and with a conical nose. Data are shown for Mach numbers of 5.2, 7.4, and 10.5 and for angles of attack of 0°, 5°, and 10°. The models are provided with a means for removing the boundary layer upstream of the flare to eliminate shock-induced separation. A perturbation method is developed for the numerical calculation of the flare shock conditions, and the resulting equations are incorporated into a computer program based on the linearized characteristics method. Comparisons are made with experiment and with other more approximate theories which have been developed for flared bodies. Author

N66-14777*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER PROGRAM FOR CALCULATING FLOW DISTRIBUTION IN A RADIAL-INFLOW TURBINE
Theodore Katsanis Washington, NASA, 1965 50 p refs
(NASA-TM-X-5216) CFSTI: HC $3.00/MF $0.50 CSCL 01A

A FORTRAN computer program for flow analysis of a radial inflow gas turbine is given. The program obtains a meridional solution on the mean surface between the blades, followed by solutions on hub, mean, and shroud blade-to-blade surfaces, in a single computer run. Suggestions for modifying the program for use with other types of turbomachines are given. Techniques for overcoming convergence problems are discussed. Author

N66-14945 General Motors Corp., Indianapolis, Inc. Allison Div.

ANALYSIS AND TESTING OF AIR COOLED TURBINI ROTOR AND STATOR BLADES

H. E. Helms and C. W. Emmerson *In its* Allison Res. and Eng. 1965 p 2–10 refs Presented at the ASME Gas Turbine Power Div. Ann. Winter Meeting, Chicago, 7–11 Nov. 1965 (See N66-14944 05-34)

The turbine airfoil cooling problem is examined and analytical methods are discussed as an aid to understanding and solving these problems. Also, the reduction of analytical methods to practical designs is covered together with a test program for the empirical evaluation of advanced designs. Current trends are enumerated and a few advance designs are suggested. E.E.B.

N66-14970# France. National Office d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.

AERODYNAMIC STUDY OF A GROUP OF VARIABLE SWEPT-BACK WINGS [ETUDE AERODYNAMIQUE D'UNE FAMILLE D'AILES A FLECHE VARIABLE]

Philippe Poisson-Quinton and Michel Enselme 1965 60 p refs In FRENCH Presented at the 6th European Cong. of Aeron. Sci., Munich, 1–4 Sep. 1965

(TP-272(1965)) CFSTI: HC $3.00/MF $0.50

The influence of the wing pivot position on the aerodynamic characteristics of a variable swept wing aircraft is studied. The problem is treated for the case of an incompressible medium, both by the method of the supporting area in a rheo-electric analogy tank, and by wind tunnel experiments on schematic models. From these tests the general laws governing the evolution of the lifting gradient and the center of pressure are deduced in terms of the variable positions of the pivot. Furthermore the nonstatic study of a particular configuration gives the evolution of pitch and roll damping during wing pivoting. The capability of the deployed wing to sustain the craft at low velocities is limited by the premature separation of the boundary layer at the leading edge of the wing; in order to lessen the incidence of separation, the conic configuration of the leading edge camber of a strongly swept wing was calculated to assure the wing's adaptation to high velocities. The experiments indicate that these curvatures noticeably improve the aerodynamic characteristics of the aircraft. Transl. by D.T.

N66-15027# Royal Aircraft Establishment, Farnborough (England).

TURBULENT SKIN FRICTION AND HEAT TRANSFER IN TWO- AND THREE-DIMENSIONAL FLOWS [FROTTEMENT ET TRANSFERT DE CHALEUR TURBULENTS EN ECOULEMENTS BI ET TRI DIMENSIONNEL]

R. Michel and Ngo Duc-Lam Sep. 1965 23 p refs Transl. into ENGLISH of Report ONERA-TP-151 Presented at the 11th Intern. Congr. of Appl. Mech., 1964

(RAE-LIB-TRANS-1131; ONERA-TP-151) CFSTI: HC $1.00/MF $0.50

This paper examines results obtained in various turbulent boundary layer problems from the treatment of integral boundary layer equations. An approximate treatment using the flat plate relationship hypothesis for skin friction and heat transfer coefficients as a function of the Reynolds numbers based on the boundary-layer thicknesses is applied especially to three major examples: (1) turbulent heat flux on a blunt body; (2) skin friction of delta wings at incidence; and (3) turbulent heat flux to a swept infinite cylinder. However, an exact investigation of turbulent heat flows in large pressure gradients raises the problem of the effect of these pressure gradients on the Reynolds analogy factor. This problem is investigated from an equation obtained by the combination of the integral equations of momentum and energy. The application to two-dimensional and axi-symmetric stagnation points produces results comparable with those for the laminar boundary layer. Author

N66-15062# Aeronautical Research Council (Gt. Brit.)

AN EXPERIMENTAL INVESTIGATION INTO THE DETERMINATION OF LIFT FROM WAKE TRAVERSES AT SUPERSONIC SPEEDS

J. Wooller and M. C. P. Firmin London, HMSO, 1965 29 p refs Supersedes RAE-TR-64010, ARC-26551; see X65-12988 (ARC-CP-801; RAE-TR-64010; ARC-26551) CFSTI: HC $2.00/MF $0.50

Two theoretical results are derived by an approximate method for relating the lift on an object to the properties of the flow in its wake. An experimental investigation was devised, firstly to compare the flow properties with those indicated by horseshoe-vortex and linearized theories, and secondly, to compare the lift derived from those properties with the lift measured by a conventional strain-gauge balance. Results are presented which indicate a maximum difference of 6% between the measurements for the lift, provided the traverses enclose the complete viscous wake, but improved theory and apparatus are necessary if the lift is to be obtained more precisely by wake traverse methods. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N66-14416# Boeing Co., Morton, Pa. Vertol Div.

TRANSMISSION STUDY FOR TANDEM-ROTOR SHAFT-DRIVEN HEAVY-LIFT HELICOPTERS Final Report, 27 Jun.–27 Dec. 1964

John Mack Ft. Eustis, Va., Army Aviation Mater. Labs., Sep. 1965 147 p refs

(Contract DA-44-177-AMC-241(T))

(R-379; USAAVLABS-TR-65-56; AD-622586) CFSTI: HC $4.00/MF $1.00

Mechanical drive systems for heavy-lift tandem-rotor helicopters were studied. Three- and four-engine configurations were analyzed. Configurations included aft-mounted and fore- and aft-mounted engines, single and dual drive systems, and high-mounted and low-mounted aft planetaries. Weights were estimated. Problems of gear surface durability, multiengine control, and over-running clutches were defined. The effects of increased gear tooth bending fatigue strength, higher bearing capacity, supercritical speed shafting, and the use of titanium and improved ferrous metals were evaluated. In the more significant factors, the satisfactory solution of the heavy-lift helicopter drive system lies within the current state-of-the-art. Author (TAB)

N66-14436# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.

POWER TRANSMISSION STUDIES FOR SHAFT-DRIVEN HEAVY-LIFT HELICOPTERS Final Report, 30 Jun. 1964–15 Feb. 1965

Lester R. Burroughs Oct. 1965 280 p refs *Its* Eng. Rept.-50401 (Contract DA-44-177-AMC-240(T))

(USAAVLABS-TR-65-40; AD-623531) CFSTI: HC $7.00/MF $1.75

The report covers a 6-month design investigation of transmission system concepts capable of operation in a single-rotor heavy-lift helicopter of 75,000 to 95,000 pounds gross weight. The study covered the selection of engines, considering engine installations utilizing models of four different engines. Specific areas considered in the design included the study of high-speed bevel gears and bearings utilized in the initial reduction stages, high torque lightweight planetary gearing and bearings, and the design of hypercritical shafting systems. The results of this study indicate that the total power transmission system weight for a single rotor HLH is approximately 8,850 pounds. This weight, which includes all gearboxes, shafting, rotor brake, and lubrication systems, is approximately 7 percent less than the results of earlier studies. The mechanical efficiency of this transmission system is greater than 96.2 percent. Studies of alternate drive concepts including the harmonic drive, the roller gear drive, and redundant power path gearing systems indicate the suitability of the roller drive for inclusion in the HLH transmission system, since this concept may afford a weight saving as high as 10 percent over conventional planetary drives. A comparative reliability analysis of the HLH and a current model aircraft designed for similar mission operation is included. Author (TAB)

N66-14584# General Dynamics Corp., Groton, Conn. Electric Boat Div.

AN EXPERIMENTAL INVESTIGATION OF INTERNAL FLOW EFFECTIVENESS FOR SEVERAL AIR CUSHION VEHICLE ARRANGEMENTS Final Report

A. M. Hall Jul. 1965 150 p refs

(Contract Nonr-4576(00))

(U413-65-116; AD-620936) CFSTI: HC $4.00/MF $1.00

An experimental investigation was conducted to determine the effect of planform and fan arrangement on internal distribution efficiency and uniformity of peripheral flow, with application to '5-Ton Payload,' logistic-type air cushion vehicles. The results indicate that overall vehicle effectiveness is highly dependent on the lift distribution system arrangement with maximum efficiencies ranging from 52 to 77 percent. For each configuration, an optimum distribution plenum height is suggested that has a notable similarity to the optimum divergence angle found in conical diffusers. Author (TAB)

N66-14822# Kaman Aircraft Corp., Bloomfield, Conn.

A MAIN POWER SYSTEM FOR SHAFT-DRIVEN HEAVY LIFT HELICOPTERS

Robert B. Bossler, Jr. Ft. Eustis, Va., Army Aviation Materiel Lab., Oct. 1965 108 p refs

(Contract DA-44-177-AMC-212(T))

(R-555; USAAVLABS-TR-65-52; AD-624145)

Multiple gas generators, installed in a conventional horizontal position, are all gas-coupled to the same peripherally-driven remote turbine of the lift and cruise fan type. The remote turbine is mounted co-axially to a speed-reducing gearbox which is also coaxial with the rotor. The concept is known as the turbine integrated geared rotor (TIGR). The TIGR arrangement eliminates from transmission design the functions of engine combining, change of direction, part of the required speed reduction from conventional engine speed to rotor speed, misalignment couplings and all of the multiple individual-engine overrunning-clutch provisions required for engineout operation and for autorotation. A three-phase program of design, analysis, and comparative evaluation of TIGR, including the effect on adjacent systems and the resulting heavy lift helicopter (HLH) aircraft, is presented. The results show TIGR has a 280 percent improvement in mean time between mission-abort failure over conventional multiple engine/transmission practice for the entire HLH power train from the engine inlets to the rotor hub, cost per HLH flight hour is reduced, and the high fuel efficiency of mechanically-driven rotors is retained. TIGR is believed to be eminently practical and is ready for dynamic testing.

Author (TAB)

N66-15200*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ESTIMATION OF FLIGHT PERFORMANCE WITH CLOSED-FORM APPROXIMATIONS TO THE EQUATIONS OF MOTION

Charlie M. Jackson, Jr. Washington, NASA, Jan. 1966 36 p refs (NASA-TR-R-228) CFSTI: HC $2.00/MF $0.50 CSCL 01C

An approximate method for calculating climb and acceleration performance of an air-breathing aircraft has been developed. Basically, the method involves linearization of the equations of motion to obtain closed-form expressions for the desired performance parameters. These expressions are applied over finite velocity intervals where the aerodynamic, propulsion, and flight-path parameters are assumed to be constant. The method is extended by a rapidly convergent iteration procedure to estimate the climb performance for a flight path limited by sonic-boom considerations. Typical examples are presented where the performance is estimated for an air-breathing boost mission to hypersonic speeds and for a complete supersonic-transport mission. The examples illustrate the simplicity of the method and show that the estimated performance is in good agreement with the results of a numerical integration of the equations of motion. The application of the approximate method to these examples indicates the utility of the method for producing performance estimates suitable for preliminary airframe design, sizing studies, propulsion-system evaluation, and cursory heat-transfer and inlet-flow-field determinations along a flight path. In order to increase the utility of the method further, nomograms are presented which provide rapid solutions to the approximate performance equations. Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N66-14464# Du Pont de Nemours (E. I.) and Co., Wilmington, Del. Pigments Dept.

HIGH TEMPERATURE THERMOELECTRIC GENERATOR Final Report, Jun. 14, 1963–Sep. 14, 1964

W. T. Hicks 7 Dec. 1964 102 p refs

(Contract NObs-88639)

(AD-623591) CFSTI: HC $3.00/MF $0.75

Design, construction, and operation of a high temperature thermoelectric generator are reported. A commercial, gas-fired heat source was used. The generator elements comprise encapsulated segments of Ta-doped WSe_2 and Na-doped PbTe as p-type materials. No appropriate n-type semiconductor was found; however, an Au-Ni alloy was discovered and developed

for use in the generator as negative legs. Total power output and efficiency were less than those calculated. Suggestions for improving generator performance and for further materials research are included. Author (TAB)

N66-14518# American Cyanamid Co., Stamford, Conn. Stamford Research Labs.
HYDROCARBON FUEL CELL ELECTRODES Progress Report, 16 Jan.–16 Jul. 1965
V. Corso, Jr. Nov. 1965 52 p
(Contract DA-44-009-AMC-897T)
(PR-1; AD-623549) CFSTI: HC $3.00/MF $0.50

The principle effort in the program was devoted to evaluating the standard American Cyanamid AA-1 electrode (9 mg Pt/sq cm) and modifications of it on hydrocarbon fuels and air at temperatures of 150–200° C with phosphoric acid as the electrolyte in a matrix type fuel cell. TAB

N66-14598# Eagle-Picher Co., Joplin, Mo. Couples Dept.
INVESTIGATIONS LEADING TO THE DESIGN AND DEVELOPMENT OF MAGNESIUM/MAGNESIUM PERCHLORATE BATTERIES Final Report, 1 Jul. 1964–30 Jun. 1965
James R. Sharpe 30 Jul. 1965 95 p
(Contract DA-28-043-AMC-00221(E))
(Rept.-4; AD-622822) CFSTI: HC $3.00/MF $0.75

The report describes the significant accomplishments made on the research and development of magnesium/magnesium perchlorate batteries. Data concerning voltage and temperature vs. type magnesium alloy are presented. Performance characteristics of Mg-HgO mutlicell batteries at low and high temperatures are discussed. Variations of electrolyte concentration and freezing point depression are discussed. Batteries for three military field applications were developed to meet the desired specifications. Author (TAB)

N66-14633*# Syracuse Univ. Research Inst., N. Y. Dept. of Mechanical and Aerospace Engineering.
NOISE INVESTIGATIONS WITH IMPINGING JET FLOWS Status Report No. 5, 1 Jun.–30 Nov. 1965
Darshan S. Dosanjh and Francis J. Montegani Dec. 1965 23 p
(Grant NsG-431)
(NASA-CR-69108; ME-1085-651205) CFSTI: HC $1.00/MF $0.50 CSCL 13G

Experimental investigations of the noise from interacting high speed jet flows show that the total acoustic power radiated peaks between 5 to 10 per cent control for a certain range of control jet impingement point locations and then decreases with increasing percent control, to a value not much higher than that for the power jet with no control flow added. For still higher percent control, the acoustic power increases again to values which even at 50 percent control are not significantly different from the peak values occurring between 5 and 10 percent control. This interesting behavior of radiated acoustic power is examined with reference to marked changes in shock structure of the underexpanded jet flow as evidenced in shadowgraphs recorded at different percent control values. The experimental data showing changes in the directivity of the noise field of the interacting jet flows with increase in percent control are also presented. Author

N66-14753*# TRW, Inc., Cleveland, Ohio. Equipment Labs.
OPTIMIZATION STUDY OF HIGH POWER STATIC INVERTERS AND CONVERTERS Final Report
R. G. Klimo, E. L. Krejny, A. B. Larson, R. J. Resch, and J. E. Murray 14 Sep. 1964 275 p refs
(Contract NAS3-2785)
(NASA-CR-54186; TRW-ER-6588) CFSTI: HC $6.00/MF $1.50 CSCL 10A

Basic performance specifications were established for optimum conceptual designs for high power static inverters. Existing designs for both series and parallel inverters were investigated so that their operating ranges and inherent advantages and limitations could be determined. Since the maximum useful load range for the series inverter was limited to approximately three to one, further research on these inverters was abandoned. A typical parallel inverter of the McMurray-Bedford type was analyzed to show that it will operate over a wide range of load magnitudes and power factors. Voltage regulation design and usage are discussed, and methods of reducing harmonic distortion are considered. Two general design approaches are obtained from this preliminary investigation, and the problems involved in one of these, a 3200 cps–10KW inverter, are detailed; this inverter, however, is not considered to offer advantages over the other one, a 400 cps–10KW inverter design. For both designs, a complete theoretical design of the low level logic circuitry was made; a complete set of schematics and parts lists is included; and relisbility, efficiency, and weight are calculated. M.W.R.

N66-14763*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ALTERNATE APPROACHES TO STERILIZABLE POWER SOURCES
Daniel G. Soltis Washington, NASA, 1965 13 p Presented at the Natl. Conf. on Spacecraft Sterilization Technol; sponsored by NASA, Pasadena, Calif., 16–18 Nov. 1965
(NASA-TM-X-52137) CFSTI: HC $1.00/MF $0.50 CSCL 10B

Resumes are presented for two projects concerned with batteries that can be sterilized and operated for useful periods of time after high temperature storage. One project, still in preliminary stages, is intended to produce an improved secondary silver-zinc battery utilizing a sterilizable inorganic separator that can operate efficiently from 50° to 210° F for at least 1500 cycles at a 25% depth of discharge. Another program deals with the development of an electrically regenerative hydrogen-oxygen cell; and present performance capabilities of this six-cell fuel cell is up to 150° C; cycle life at full depth at 90° C is greater than 300; and operating current density discharge is 100 mA/cm^2. Overload capability is 2:1, and thermal sterilization is possible. Both approaches for obtaining sterilizable secondary batteries have a chance of meeting requirements for a lander mission. Major problems are concerned with the conversion of a laboratory device into a reliable piece of flight hardware. M.W.R.

N66-14766*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME PROBLEMS OF THE THIN FILM CADMIUM SULFIDE SOLAR CELL
A. E. Spakowski, A. E. Potter, and R. L. Schalla Washington, NASA, 1965 17 p Presented at the 5th Photovoltaic Specialists Conf., Washington, D. C., 18–20 Oct. 1965
(NASA-TM-X-52144) CFSTI: HC $1.00/MF $0.50 CSCL 10A

Storage, humidity, thermal cycling, and mechanism are considered as the major problems associated with thin film cadmium sulfide solar cells. Grids that are firmly attached to the cell can eliminate instability during storage, and proper construction methods can produce thin film cells that are very resistant to thermal cycling. Plastic substrates and electroplated grid cells have been made to withstand 10000 cycles, the equivalent of two years in orbit. It is found that the cells can be exposed to 20% relative humidity with little or no damage for periods of time long enough to assemble an array. The cell mechanism appears to be a heterojunction of cadmium sulfide and copper sulfide. Evidence indicates that excess cadmium is responsible for the red response of the heated film. M.W.R.

N66-14769*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FUEL CELLS

Harvey J. Schwartz Washington, NASA, 1965 22 p Presented at the 58th AIChE Natl. Meeting, Philadelphia, 5–9 Dec. 1965 (NASA-TM-X-52149) CFSTI: HC $1.00/MF $0.50 CSCL 10A

The flight of Gemini V marked the first demonstration of the use of fuel cells as spacecraft power systems. They have also been selected to power the NASA's Apollo and Biosatellite spacecraft and are prime candidates for use on the Air Force's Manned Orbiting Laboratory. A fuel cell may be considered to be an isothermal steady-state reactor in which the conversion of hydrogen and oxygen to water is accomplished. In order to maintain steady-state operation, heat and product removal techniques must be applied to the fuel cell. Three hydrogen-oxygen fuel cell systems are currently under development for aerospace applications. The three are described in terms of their basic operating parameters and construction features. The methods by which each system accomplishes the required heat-and mass-transfer operations are described. Author

N66-14772*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MATERIAL AND GEOMETRY ASPECTS OF SPACE RADIATORS

Seymour Lieblein and James H. Diedrich Washington, NASA, 1965 28 p refs Presented at the Am. Nucl. Soc. Winter Meeting, Washington, D. C., 15–18 Nov. 1965 (NASA-TM-X-52153) CFSTI: HC $2.00/MF $0.50 CSCL 13A

Space-radiator materials and fin-tube geometry have a large influence on the ultimate size and weight of the radiator. Many factors, in turn, influence the requirements for materials and geometry, such as meteoroid damage protection, structural integrity, vehicle integration, and fluid compatibility. Similarly, there is a wide variety of materials and geometries that can be considered. It appears that a completely satisfactory solution of the materials-geometry question for advanced Rankine power systems is not yet in hand. Author

N66-14775*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SURVEY OF ELECTRIC POWER PLANTS FOR SPACE APPLICATIONS

Lloyd I. Shure and Harvey J. Schwartz Washington, NASA, 1965 39 p Presented at the 58th AIChE Natl. Meeting, Philadelphia, 5–9 Dec. 1965

(NASA-TM-X-52158) CFSTI: HC $2.00/MF $0.50 CSCL 10B

Modification of existing techniques and technologies to meet the requirements of space power programs is considered in a general review of presently available power sources. Fuel and solar cells are discussed as are chemical batteries and thermoelectric generators. Rankine and Brayton cycle power plants for space usage are mentioned, along with their possibilities and characteristics. Principle of operation, characteristics, and possible use of the thermionic converter is also considered M.W.R.

N66-14786*# Alfred Univ., N. Y.

FUEL CELL RESEARCH: AN INVESTIGATION OF NON-STEADY-STATE OPERATION Final Report, 1 Jun. 1963–1 Jun. 1965

T. J. Gray, A. A. Schneider, R. B. Rozelle, and M. L. Soeder Dec. 1965 38 p refs

(Grant NsG-384)

(NASA-CR-54768) CFSTI: HC $2.00/MF $0.50 CSCL 10A

The development of a working pulse loading device and the preliminary performance data of a fuel cell subjected to pulse loading are discussed. It was anticipated and later experimentally verified that pulsed loading would produce an improvement in cell performance only if the average pulsed current were such that if the cell were operated at this current under steady load, concentration polarization would be the limiting factor in cell performance. Laboratory work on the application of galvanostatic techniques to fuel cell electrodes is reported. Galvanostatic curves reflect the presence of adsorbed or chemically combined species at an electrode surface, the nature and detailed characteristics of the electrical double layer, and an exact thermodynamic description of the condition at the electrode at all times. Application of this technique to fuel cell electrodes has facilitated the study of catalytic treatment and permitted the optimizing of electrode treatment as well as providing a rapid technique for qualitative screening of electrodes before introduction into a working fuel cell. An investigation by means of galvanostatic charging curves of the occlusion of hydrogen and of surface oxide formation in a series of palladium–gold alloys is summarized. M.R.W.

N66-14814# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

EFFECTS OF PASSIVE ATTITUDE CONTROL ON SOLAR POWER SYSTEMS

Robert E. Fischell 5 May 1964 24 p refs

(Contract NOw-62-0604-c)

(CF-3077; AD-622483)

There is a strong relationship between a spacecraft's attitude control system and its capability for generating electrical power from solar cells. The effects of four particularly interesting passive attitude control techniques on the spacecraft's solar power system are discussed. These four techniques are: solar stabilization, spin stabilization, magnetic stabilization, Gravity Gradient Stabilization. TAB

N66-14854# Rocketdyne, Canoga Park, Calif. Spacecraft Engine Div.

INVESTIGATION OF A MOVING BELT RADIATOR Second Quarterly Progress Report, 1 Aug.–1 Nov. 1965

Nov. 1965 81 p refs

(Contract AF 33(615)-2813)

(R-6289-2; AD-624124) CFSTI: HC $3.00/MF $0.75

The report covers the second quarter of a continuing research program on the feasibility of the moving belt radiator, a novel concept for the rejection of waste heat in space. The chief concerns of the program are materials compatibility, thermal conduction between surfaces, and antifriction bearing operation (all at high temperature in a hard vaccum), and the dynamic behavior of the belt, roller, and drum system under simulated in-flight conditions. During this report period, the materials compatibility and heat transfer investigations in the reciprocating-contact testers and the small-scale model were continued; and the bearing investigation was continued with the performance of seven tests of size 204 bearings. The fabrication of the pilot model for dynamic simulation of in-flight operation is nearing completion, and the design of the 1/5-scale dynamic model is in progress. Author (TAB)

N66-14938# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

RESEARCH ON NEW CONCEPTS IN ENERGY CONVERSION Quarterly Technical Progress Report, Jun. 1–Aug. 31, 1965

W. D. Jackson, G. A. Brown, J. L. Kerrebrock, and R. E. Stickney Wright-Patterson AFB, Ohio, AF Mater. Lab., 15 Aug. 1965 40 p refs

(Contract AF 33(615)-1083)

(QTPR-8; AD-622945) CFSTI: HC $2.00/MF $0.50

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12. BRAYTON CYCLE MAGNETOHYDRODYNAMIC POWER GENERATOR p 30-31 ref

N66-14939 Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

STEAM-WATER CONDENSING EJECTOR TEST FACILITY

B. T. Lubin and G. A. Brown *In its* Res. on New Concepts in Energy Conversion 15 Aug. 1965 p 5-6 refs (See N66-14938 05-03) CFSTI: HC $2.00/MF $0.50

A steam-water condensing ejector test facility has been constructed to obtain pressure data in the low flow rate ratios and high mixing-section contraction ratios. Stagnation-pressure operation of the facility is 50 to 180 psia, with a design flow-rate ratio of 2.73 and an area contraction ratio of 11.0. Theoretical and experimental calculations for exit versus inlet stagnation pressure ratios are found to agree within 10%.

M.W.R.

N66-14965*# Hughes Aircraft Co., Culver City, Calif. Aerospace Group.

NON DISSIPATIVE SOLAR ARRAY OPTIMUM CHARGE REGULATOR First Quarterly Report

Oct. 1965 72 p

(Contract NAS5-9211)

(NASA-CR-69198; P65-125) CFSTI: HC $3.00/MF $0.75 CSCL 10B

Research efforts in the field of optimum power transfer circuits capable of coupling a spacecraft solar array to a spacecraft type battery under specified mission environmental conditions, are summarized. A switching mode regulator was selected as the means of power transfer in place of the linear amplifier regulator formerly used. The switching mode regulator achieves high efficiency due to the fact that the main power transistor is either in the saturated condition on in the open condition. Therefore the major power loss occurs during the time that the transistor is switching between these two states. In addition, research in the area of optimum coupling and control techniques was performed. An extremal seeking controller was found to be the best means by which optimum power transfer could be realized. Work was also performed to determine the types of battery systems that could be effectively utilized. Orbital conditions were derived and batteries were selected which would meet the given performance requirements. Battery control devices to permit sensing of optimum charge were investigated. L.S.

N66-15012*# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.

RADIATION EFFECTS ON SILICON SOLAR CELLS Final Report, Dec. 1, 1961-Dec. 31, 1962

V. A. J. van Lint, J. W. Harrity, H. Horiye, S. W. Kurnick, D. K. Nichols et al 15 Feb. 1963 145 p refs

(Contract NAS7-91; Gen. Atomic Proj. 258)

(NASA-CR-69139; GA-3872) CFSTI: HC $4.00/MF $1.00 CSCL 10A

Experiments have been performed to study the defects introduced into silicon by high energy (~30 Mev) electron irradiation. These defects are expected to be similar to those produced by high-energy protons. The diagnostic tools used include measurements of galvanomagnetic coefficients, excess carrier lifetime, electron-spin resonance, and infrared absorption. The results indicate that the A center in quartz-crucible-grown silicon is not the primary excess-carrier recombination center. Instead, recombination in quartz-crucible-grown and floating-zone refined silicon appears to be dominated by the same center. This center exhibits a strong dependence of the excess-carrier lifetime on excess-carrier density, with increasing lifetime at higher densities. The temperature dependence of the excess carrier lifetime appears to indicate an ionization energy of approximately 0.12 ev, and this same level is seen in the galvanomagnetic measurements. However, this activation energy may not be real, due to a strong temperature dependence of the recombination cross sections. A variety of other energy levels have been identified by the galvanomagnetic measurements and the rates of introduction of defects have been measured.

Author

N66-15024*# Allis-Chalmers Mfg. Co., Milwaukee, Wis. Research Div.

RESEARCH AND DEVELOPMENT OF OPEN CYCLE FUEL CELLS Second Quarterly Progress Report, Period Ending Feb. 15, 1966

R. Desai, G. Monette, and C. Williams 15 Mar. 1965 60 p refs

(Contract NAS8-5392)

(NASA-CR-69082; NAS8-5392-QPR-002) CFSTI: HC $2.00/MF $0.50 CSCL 10A

Design charts based on the study of the problem of storage in a low temperature environment are presented. The study on the range of applicability of a fuel cell power supply is expanded and basic subsystems examined. The subroutines on space radiators, and on fuel cell-rechargeable battery combinations being readied for insertion in the existing fuel cell power system parameter optimization computer program are described. The computer program for the mathematical representation of the static vapor pressure method of water removal is described.

Author

N66-15103# Allis-Chalmers Mfg. Co., Milwaukee, Wis. Space and Defense Sciences Dept.

DESIGN OF HYDROGEN-OXYGEN CAPILLARY TYPE FUEL CELL Quarterly Technical Progress Report, 1 Aug.-31 Oct. 1965

15 Nov. 1965 29 p

(Contract AF 33(615)-1185)

(QTPR-8; AD-624158) CFSTI: HC $1.00/MF $0.50

The design of the 1965 modules is complete and improvements were made in the thermal control system and the cell plate design. Advance design studies are in progress. Design verification tests of components are also underway. The orbital fuel cell experiment was attempted, but a vehicle course deviation necessitated its destruction. Author (TAB)

N66-15177# Marquardt Corp., Van Nuys, Calif.
INVESTIGATION OF THE CURRENT DENSITY LIMITATIONS IN A THERMIONIC CONVERTER Technical Summary Report, 1 Nov. 1963–31 Oct. 1964
C. Kaplan and J. B. Merzenich [1964] 28 p refs Submitted for Publication
(Contract Nonr-3738(00))
(Rept.-25150; AD-608551) CFSTI: HC $2.00/MF $0.50

A large number of current-versus-voltage curves were obtained, using pure cesium and also a cesium-xenon mixture (Cs+Xe). Comparison of the Cs+Xe data with the Cs data shows that the addition of 60 torr of xenon gas to the converter yielded an increase of from 15 to 80% in output power, for a fixed emitter temperature and a given output voltage. Pulsed-discharge experiments were performed with pure cesium (Cs) and also with a cexium–xenon mixture (Cs+Xe). A high-current pulse was applied to the converter, followed by rapid switching to lower current levels. The pulsed current-voltage characteristic, obtained by measuring the current and voltage just after the pulse, indicates that the transport losses in the converter are eliminated by the excess positive ions produced during the pulse. The electron current just after the pulse is limited only by the work function barriers. TAB

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N66-14340*# School of Aerospace Medicine, Brooks AFB, Tex. Aerospace Medical Div.
EXPERIMENTAL ANIMAL DECOMPRESSIONS TO A NEAR-VACUUM ENVIRONMENT. EXPERIMENTAL ANIMAL DECOMPRESSIONS TO LESS THAN 2 MM. HG ABSOLUTE (PATHOLOGIC EFFECTS)
James E. Dunn, II and Richard W. Bancroft Jun. 1965 27 p refs Presented at the Aerospace Med. Assoc. Meeting, Miami Beach, Fla., 12 May 1964
(NASA Order DPR T-16758-G)
(NASA-CR-68987; SAM-TR-65-48) CFSTI: HC $2.00/MF $0.50 CSCL06C

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N66-14341* School of Aerospace Medicine, Brooks AFB, Tex. Aerospace Medical Div.
EXPERIMENTAL ANIMAL DECOMPRESSIONS TO A NEAR-VACUUM ENVIRONMENT
Richard W. Bancroft and James E. Dunn, II *In its* Exptl. Animal Decompressions to a Near-Vaccum Environment Jun. 1965 11 p refs (See N66-14340 05-04) CFSTI: HC $2.00/MF $0.50

To estimate the times of consciousness, collapse, and survival of animals exposed to near-vacuum environments, 126 conscious dogs were rapidly decompressed in either 1 or 0.2 second from 35,000 feet, while breathing oxygen, to a pressure less than 2 mm. Hg absolute. Groups of 6 dogs each were exposed to this low pressure for periods of time ranging from 5 to 180 seconds, with and without prior denitrogenation, and then recompressed to 35,000 feet with oxygen in either 5 or 30 seconds. The dogs collapsed within 9 to 10 seconds after decompression, as determined from motion picture films. Simultaneously, the effects of anoxia, water vapor, and other evolved gases were apparent, resulting in a generalized muscle spasticity, a few gasps, momentary convulsive seizures, apnea, and gross swelling of the body and extremities. All dogs exposed for less than 120 seconds survived, despite evidence of lung involvement. Respiration recommenced spontaneously either during recompression or at ground level, providing the heart was beating; otherwise, death was inevitable. Exposures of 120 to 180 seconds resulted in approximately 15% to more than 80% fatalities, respectively. Denitrogenated dogs tended to show a slightly better survival rate. Author

N66-14342* School of Aerospace Medicine, Brooks AFB, Tex. Aerospace Medical Div.
EXPERIMENTAL ANIMAL DECOMPRESSIONS TO LESS THAN 2 MM. HG ABSOLUTE (PATHOLOGIC EFFECTS)
James E. Dunn, II, Richard W. Bancroft, Webb Haymaker (NASA, Ames Center), and John W. Foft *In its* Exptl. Animal Decompressions to a Near-Vacuum Environment Jun. 1965 14 p refs (See N66-14340 05-04) CFSTI: HC $2.00/MF $0.50

Pathologic examination of tissues of dogs rapidly decompressed to less than 2 mm. Hg absolute was performed. Of the 126 dogs decompressed, 92 were autopsied at 3 time intervals: within 30 minutes, 2 to 5 days, and 1 to 3 weeks post-decompression. Gross examination of the tissues was performed on all autopsied animals. Lung damage was graded 1+ to 4+ according to the amount of edema, emphysema, atelectasis, and hemorrhage present alone or in combination. Microscopic examination of the tissues was performed on selected dogs from the various groups. The most impressive finding was the absence of major pathologic damage, except in the lungs, unless the exposure time exceeded 120 seconds. By varying time of decompression and time of exposure to less than 2 mm. Hg, it was possible to separate the pathologic effects of anoxia versus time of decompression. For the exposures that were longer than 120 seconds, gross examination of other organs and tissues showed increasing congestion and some hemorrhage. The brains showed engorgement without evidence of hemorrhage. One dog that was paralyzed from the exposure had numerous demyelinated lesions of the spinal cord that seemed to be the result of gas bubble emboli. Author

N66-14359# European Atomic Energy Community, Brussels (Belgium).
THE FEASIBILITY OF A NEW PROCEDURE FOR BIOLOGICAL DOSIMETRY
J. F. Whitfield, S. Kellerer, H. Brohee, and T. Youdale 1965 35 p refs
(EUR-2505.e) CFSTI: HC $2.00/MF $0.50

Proportion of rat as well as human lymphocytes with structureless (or pycnotic) nuclei can serve as a sensitive indicator of absorbed radiation dose (following an acute exposure) provided that the irradiated cells are removed from the blood and maintained in a glucose-phosphate medium. At the present stage of development the dosimeter is particularly sensitive to doses between 0 and 100 r. Above 100 r, the slope of the linear dose-effect curve tends to decrease and the dosimeter becomes less sensitive. Author

N66-14363# Strasbourg Univ. (France).
EXPERIMENTAL STUDY OF THE TREATMENT OF RADIATION INJURIES BY PADUTIN (KALLICREINE) [ETUDE EXPERIMENTALE DU TRAITMENT DES RADIOLESIONS PAR LA PADUTINE—DEPOT (KALLICREINE)]

P. Mandel, J. M. Mantz, C. Gary, M. Delemen, P. Michaelidis et al Brussels, EURATOM, 1965 22 p In FRENCH; ENGLISH summary
(EURATOM-054-63-10 BIOF)
(EUR-2477.f, Vol. I) CFSTI: HC $1.00/MF $0.50

Experiments confirm the value of Padutin in the treatment of radiodermatitis and radionecrosis in rats and guinea pigs. Data indicate that Padutin dosage can be stepped up. Comparison of Padutin with AET, another vasodilating agent, reveals positive results for Padutin and contraindication for the use of AET in certain instances. Studies are under way to compare the eventual protective effects of these same drugs following whole body irradiation; and preliminary results are favorable for both drugs. Biochemical studies of Padutin are also in progress. It is also reported that the mitotic index and the collagen determination appear to be valid biological criteria for quantitative appreciation of the cicatrization phenomenon. M.W.R.

N66-14367# Joint Publications Research Service, Washington, D. C.
THE EFFECT ON THE LIVING ORGANISM OF NEW TOXIC SUBSTANCES USED IN INDUSTRY
26 Nov. 1965 30 p refs Transl. into ENGLISH from Gigiyena Truda i Prof. Zabolivaniya (Moscow), no. 6, Jun. 1965 p 19–24, 40–48, 63–64
(JPRS-33038; TT-65-33615) CFSTI: $2.00

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1. DATA ON NEUROHUMORAL SHIFTS OCCURRING UNDER THE EFFECT OF CHLOROPRENE Ye. I. Gasparyan p 1–9 refs

2. DATA SUBSTANTIATING MAXIMUM PERMISSIBLE CONCENTRATIONS OF SOME INSOLUBLE MOLYBDENUM COMPOUNDS O. Ya. Mogilevskaya p 10–17 refs

3. ON THE TOXICITY OF GALLIUM COMPOUNDS V. V. Podosinovskiy p 18–24 refs

4. SOME OBSERVATIONS RELATIVE TO THE ARTICLE "AN INVESTIGATION OF NERVOUS SYSTEM FUNCTIONS IN TOXICOLOGICAL EXPERIMENTS" A. I. Korbakova p 25–27

N66-14383*# National Aeronautics and Space Administration, Washington, D. C.
INFLUENCE OF GRAVITY ON THE BLOOD CIRCULATION; DIAGNOSTICS OF SYNCOPE AND APOPLEXY [INFLUENCE DE LA PESANTEUR SUR LE COURS DU SANG; DIAGNOSTIC DE LA SYNCOPE ET DE L'APOPLEXIE]
Piorry Jan. 1966 5 p Transl. into ENGLISH from Arch. Gen. Med. (Paris), v. 11, 1826 p 292–294
(NASA-TT-F-9844) CFSTI: HC $1.00/MF $0.50 CSCL 06S

A paper on experiments to determine the possible causes of syncopes is abstracted. Human subjects, in true syncope, were revived by changing their erect position to a horizontal position, with the head lower than the trunk, indicating a clear influence of gravity. Bichat's theory that syncope is produced by suspension of cardiac action is disputed, emphasizing that interruption of blood flow to the brain is the primary cause. Author

N66-14443# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
THE EFFECTS OF HIGH AMBIENT TEMPERATURE ON SHORT-TERM MEMORY
John F. Wing and Robert M. Touchstone Sep. 1965 26 p refs
(AMRL-TR-65-103; AD-623683) CFSTI: HC $2.00/MF $0.50

The study was designed to determine whether or not an increase in ambient temperature impaired man's ability to recall aurally-presented messages, and whether impairment was greater for some types of messages than for others. On three separate days, 15 men were exposed for 1 hour in an all-weather chamber to each of three different effective temperatures (ET): 72F, 90F, and 95F. During each day's session they were given five successive recall trials on each of six different messages. The men had to work continuously during each hour-long session. The results showed that average recall dropped significantly as environmental temperature was increased. The recall decrement between 90F and 95F was statistically significant, but the drop in recall between 72F and 90F was not significant. Messages of all types suffered approximately equal decrements under the high temperatures. Author (TAB)

N66-14635*# Naval School of Aviation Medicine, Pensacola, Fla.
CLINICAL PATHOLOGICAL CORRELATIONS IN SQUIRREL MONKEYS AFTER SUPPRESSION OF SEMICIRCULAR CANAL FUNCTION BY STREPTOMYCIN SULFATE
Makoto Igarashi, Michael E. Mc Leod, and Ashton Graybiel 14 Jul. 1965 41 p refs *Its* Rept.-117
(NASA Order R-93)
(NASA-CR-69105; NSAM-940) CFSTI: HC $2.00/MF $0.50 CSCL 06E

Streptomycin sulfate was injected to eight selected squirrel monkeys in sufficient dosage to cause suppression of canal function as indicated by the threshold caloric test, emesis in the slow rotation room, and ataxia. The animals were sacrificed six months after the suppression and slides for light-microscopic investigation were prepared following the standard temporal bone preparation procedure. Pathological findings were confined largely to the cristae and organ of Corti, which were both involved in almost every case. Only very slight changes were observed in the maculae in a few instances; therefore, this drug has a place in vestibular studies requiring selective suppression of canal function. The clinical tests used were not reliable indicators of the pathophysiological state of the cristae but were fairly reliable indicators of normal function of these organs. With regard to emesis in the SRR and ataxia, the essentiality of normal function of the semicircular canals has been demonstrated. No such essentiality was demonstrated for the otolith organs in the present investigation. Author

N66-14638*# Maryland Univ., College Park.
CHLORELLA, PHYSIOLOGY AND TAXONOMY OF FORTY-ONE ISOLATES
Ikuko Shihira and Robert W. Krauss [1965] 106 p refs
(Grant NsG-70)
(NASA-CR-69107) CFSTI: HC $4.00/MF $0.75 CSCL 06C

Forty-one isolates of the genus *Chlorella* were examined to established physiological and morphological characteristics of taxonomic value. The algae were grown free of bacteria, under controlled light and temperature conditions, in liquid shake-cultures. From standardized cultures the algae were photographed in color and described according to their morphology, with special emphasis on the structure of the chromatophore. Comparisons of morphology were made between algae growing on organic and inorganic media. Physiological response to hexoses, pentoses, mono-, di-, and tri-saccharides, and dextrin were recorded for cultures growing in both light and darkness. Ability to use, and preferences for NO_3, NH_3, amino acids, and proteins were observed. Vitamin requirements were determined. Pigment changes indicated tendencies of the organisms to either heterotrophic or autotrophic growth, and suggested evolutionary patterns within the genus. Two subgenera were differentiated. The physiological characteristics of the species were reviewed in the light of morphological similarities, and schematic diagrams were presented to compare

the major types of nutrition to that of idealized heterotrophs and autotrophs. Author

N66-14640# City of Hope Medical Center, Duarte, Calif.
BIOCHEMICAL STUDIES ON ACUTE HYDRAZINE TOXICITY IN MICE Final Research Report
Eugene Roberts and Daisy G. Simonsen 8 Nov. 1965 33p refs
(Contract AF 41(609)-2614)

Two-dimensional paper chromatographic methods were employed to study the changes produced in amino acid distribution in tissues of normal mice, mice treated with hydrazine, and mice pretreated with protective amino acids prior to injection with hydrazine. The data suggest that acute hydrazine toxicity does not coincide with any major effects on carbohydrate or amino acid metabolism of the brain but occurs when significant changes are noted in amino acid distribution in the liver. Particular attention was paid to arginine metabolism. Although arginine injection produced only an increase in ornithine content in the liver, when arginine was followed in 30 minutes by the administration of hydrazine there were marked increases in both ornithine and citrulline levels. In no instance was there any evidence of argininosuccinic acid. The data were tentatively interpreted to indicate that the rate-limiting step in the ornithine cycle of liver may be the carbamylation of ornithine, but that in hydrazine-poisoned animals the condensation reaction of citrulline with aspartic acid to give argininosuccinic acid might become rate-limiting. Lipid analyses of livers of control and hydrazine-treated mice showed that no significant abnormalities occurred in the distributions of the individual constituents as a result of hydrazine injection at a time that marked changes in amino acid content were noted. Author

N66-14658# Joint Publications Research Service, Washington, D. C.
ACCLIMATIZATION OF FISH AND FOOD ORGANISMS IN THE SEAS OF THE USSR
G. L. Shkorbatov 28 Dec. 1965 12 p Transl. into ENGLISH from Zool. Zh. (Moscow), v. 44, no. 10, 1965 p 1585–1588
(JPRS-33497; TT-65-34071) CFSTI: $1.00

A review is presented of a collection of articles on the acclimatization of fish and food organisms in Russian seas. The material shows how research should be conducted during realization of broad plans to reconstruct the flora and fauna on a scale incorporating entire sea basins. Mention is given to particular works which include such areas as hybridization of fish, histological analysis, and salt tolerances of particular fish. C.T.C.

N66-14667# Library of Congress, Washington, D. C. Aerospace Technology Div.
EFFECT OF IONIZING RADIATION ON ANIMALS AND PLANTS Surveys of Soviet Scientific and Technical Literature
Janice L. Smith 8 Dec. 1965 25 p refs Compilation of abstracts
(ATD-65-110)

Presented are 10 articles which include experimental and theoretical studies on ionizing radiation effects of living organisms. Comparative studies of the radiosensitivity of different animal strains and species, determination of the RBE of different types of ionizing radiation, and investigation of the relationship between the age of animals and their radiosensitivity are considered. Newer research areas include protein metabolism in animals under the influence of radiation, changes in the proteolytic activity of blood during irradiation, and the neurohumoral mechanism of the remote radiation effect. R.W.H.

N66-14671# Joint Publications Research Service, Washington, D. C.
MAGNETOBIOLOGY
Yu. A. Kholodov 14 Dec. 1965 26 p Transl. into ENGLISH from Priroda (Moscow), no. 10, Oct. 1965 p 12–21
(JPRS-33321; TT-65-33896)

A general discussion is given of the effect of strong magnetic fields on living organisms. A brief history of the problem is presented, and specific experiments are cited. Field effects are included for such areas as therapeutics; bacteria functions, growth, and development; navigation of migrating animals; and the human nervous system. C.T.C.

N66-14728# School of Aerospace Medicine, Brooks AFB, Tex.
SOME EFFECTS OF WHOLE-BODY 32 MeV PROTON IRRADIATION ON PRIMATES. THE RADIATIONS OF SPACE II, 1 JUNE 1964–1 MARCH 1965
Glenn V. Dalrymple, Ian R. Lindsay, John J. Ghidoni, Harold L. Kundel, Edwin T. Still et al Jun. 1965 38 p refs Prepared in cooperation with Texas Nucl. Corp.
(Contract AF 41(609)-2418)
(SAM-TR-65-43; AD-471676)

Eighty primates (Macaca mulatta) were irradiated with spaced doses of 32 Mev protons (280 to 6,700 rads). The highest doses (5,200 to 6,700 rads) produced severe disease of the central nervous system and convulsions. Intermediate doses (1,400 to 4,200 rads) caused marked infection. Mortality patterns, blood counts, Fe^{59} ferrokinetics, clinical manifestations, and histopathologic studies showed no evidence of either gastrointestinal or hematologic radiation changes. This situation was anticipated since the average transverse diameter of the primate (10 cm.) was considerably larger than the range of the protons (1 cm. in soft tissue). Because of the absence of injury to the bone marrow or gastrointestinal tract, mortality was relatively delayed after irradiation; an $LD_{50/60}$ of 1596 ±101 rads was estimated from the cumulative mortality data. The postirradiation course of animals dying from a cutaneous mechanism was in many ways similar to that found following third-degree, thermal burns. Author (TAB)

N66-14741# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHYSIOLOGICAL EFFECTS OF GRAVITATION
O. G. Gazenko and A. A. Gurjian 7 Oct. 1965 34 p refs Transl. into ENGLISH of a Russian paper presented at the COSPAR 8th Plenary Session and the 6th Intern. Symp. on Cosmic Sci., Buenos Aires, 10–21 May 1963
(FTD-MT-65-223; AD-622758) CFSTI: HC $2.00/MF $0.50

The physiological effects of prolonged weightlessness are discussed. The circumstance that living organisms in the course of evolution did not encounter prolonged action of modified gravitational and inertial conditions must have put its imprint on the peculiarities of the organism's reactions. It is possible to consider that the organism does not possess prepared, specific mechanisms of adaptation or ready mechanisms of compensation and separation of functions which suffer under conditions of prolonged weightlessness. This premise is considered during the analysis of reactions of the organism to modified gravitational conditions. The biological effect of such dynamic factors of flight as the relatively brief action of accelerations and vibration are not considered in this report. Of special interest is the question of what sort of mutual relationships exist between the effects of heightened and reduced gravitational weightlessness. E.E.B.

N66-14788# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
BODY FLUID VOLUMES AND THE RENAL RESPONSE OF HUMAN SUBJECTS TO WATER IMMERSION Final Report, Oct.–Dec. 1964
Michael Mc Cally Aug. 1965 33 p refs
(AMRL-TR-65-115; AD-623724) CFSTI: HC $2.00/MF $0.50

Immersion of human subjects in water is used to simulate various aspects of the aerospace environment, including weightlessness. However, little is known of the physiological cardiovascular and renal responses to immersion. Such data are necessary before responses to immersion can be related to other environments, such as aerospace. The excretion of water and solute by the kidney is the fundamental mechanism for preserving the constancy of the mammalian extracellular fluid. The mechanisms by which the kidney is notified to retain or excrete water and solute in response to changes in the environment have been defined in considerable detail in recent years. The response of the kidney to water immersion of human subjects, as measured by water and solute excretion, provides a fascinating model for the study of body fluid volume regulation. The Ama divers of Japan and Korea represent specific problems of body fluid volume regulation during immersion as dictated by the depth, duration, temperature and respiratory mechanics of their particular immersion pattern. Author (TAB)

N66-14818# Missouri Univ., Columbia.
ENERGY METABOLISM OF THE CHIMPANZEE—A COMPARISON OF DIRECT AND INDIRECT CALORIMETRY Final Report, Sep. 1963–Apr. 1965
H. E. Dale, M. D. Shanklin, H. D. Johnson, and W. H. Brown Holloman AFB, N. Mex., 6571st Aeromed. Res. Lab., Sep. 1965 80 p refs *Its* J. Ser.-3004
(Contract AF 29(600)-4126)
(ARL-TR-65-17; AD-622438) CFSTI: HC $5.00/MF $1.00

Energy Metabolism of the chimpanzee was studied using simultaneously the techniques of direct and indirect calorimetry. The principal objective was to relate the magnitude and variability of the basal metabolic rate measured with the two techniques. Heat loss was measured with a thermoelectric, or gradient, partitional calorimeter; heat production was calculated from oxygen consumption measured with a Pauling meter and carbon dioxide production measured by infrared absorption. A total of 827 determinations were made on 14 chimpanzees, 7 males and 7 females. The animals were housed and measurements were made at an environmental temperature of 75° F. All measurements were made in the morning between 8:00 and 12:00 o'clock noon; the subjects were awake, 15 to 18 hours postprandial, and confined to a relatively small cage. From each 40 minute test period a 10 minute low period was delineated to serve as an estimate of the basal metabolic rate. Author (TAB)

N66-14830* National Aeronautics and Space Administration, Washington, D. C.
REPORT OF BIOSCIENCE WORKING GROUP
In its NASA 1965 Summer Conf. on Lunar Exploration and Sci. 1965 p 223–244 (See N66-14826 05-04) GPO: HC $0.50; CFSTI: MF $2.25

With regard to the lunar exploration program, areas of interest in the biosciences are considered in terms of basic and fundamental research endeavors and contamination control activities. Objectives and methods are discussed for both types of studies. The search for viable or nonviable organisms, for existing or past life systems, and for life-associated macromolecules is mentioned along with microbiological tests that could be performed on lunar sample materials. A discussion of contamination control stresses the need for collecting biologically clean lunar samples. Contamination to the moon from the landing module itself, leakage from astronaut clothing, and fuel combustion are considered; and back-contamination to earth from lunar materials is considered in terms of sampling techniques and packaging procedures. Training of astronauts to accomplish these tasks is discussed. M.W.R.

N66-14855# Texas Christian Univ., Fort Worth. Inst. of Behavioral Research.
COLD STRESS: PARAMETERS, EFFECTS, MITIGATION Technical Report, Jan. 1960–Dec. 1964
Nurhan Findikyan and S. B. Sells Ft. Wainwright, Alaska, AAL, Sep. 1965 49 p refs
(Contract AF 41(657)-323)
(AAL-TR-65-5; AD-624044) CFSTI: HC $1.00/MF $0.50

The complex interaction of cold stress with environmental and organismic variables in exercising influence on human performance is a problem that still requires extensive investigation. Some relatively well-known interactions of cold with other stressors are reviewed. A description of the functioning of thermoregulative mechanisms in relation to cold stress and cold injury as a result of exposure in extreme climates is presented. Ways and means of counteracting cold stress to improve task performance are emphasized. The literature relating personnel selection, acclimatization, training, indoctrination, leadership, morale, and physical protection to the mitigation of cold stress and to measures of performance effectiveness is reviewed. Despite the paucity of meaningful data, it is felt that adequate and encouraging progress is being made in the understanding of the psychophysiology of cold stress. Author (TAB)

N66-14863 State Univ. of New York, Stony Brook. Coll. of Engineering.
KINETICS OF PROTEIN SYNTHESIS BY POLYRIBOSOMES
I. Gerst and S. N. Levine [1963] 40 p refs
(Contract Nonr-4006(00); Grant AF-AFOSR-667-64)
(AD-606553) CFSTI: HC $2.00/MF $0.50

The report investigates the kinetics of polyribosome mediated protein synthesis. A fairly general but still tractable deterministic linear model is presented which allows for messenger RNA sources of arbitrary functional form and also takes into account any deterioration of the messenger RNA which may occur during the course of protein synthesis. Author (TAB)

N66-14905*# Space-General Corp., El Monte, Calif.
PHOTOSYNTHETIC HALOPHILES FROM OWENS LAKE Final Report
R. W. Tew Washington, NASA, Jan. 1966 71 p refs
(Contract NASw-1037)
(NASA-CR-361) CFSTI: HC $3.00/MF $0.75 CSCL 06M

Studies of growth limitation by water have been accomplished with halophilic, anaerobically photosynthetic bacteria from an halite-thenardite-trona evaporite deposit. A purified isolate has been identified as a member of the group of small *Chromatium* species promoting sulfur formation in the growth medium. The optimum a_w for rapid growth of this organism appears to be .95. In solutions of NaCl or of sodium carbonates at pH 9.5, growth is a function of a_w; in sodium sulfate brines the response is also related to a property of the solute. Generation times were 78 and 13 hours in media having water activities of .76 and .95. Growth has been studied in biphasic systems in which the concentration of more than one solute, water activity, and the composition of the solid phase were predicted by phase rule. Organisms trapped within mirabilite crystals during these experiments survived liquid nitrogen temperatures and subsequent exposure to vacuum. Initial results of a theoretical

study of halophilic growth indicated that, in the saturated solutions used, water does not move osmotically, but must be pumped into the cell. Author

N66-15003# Joint Publications Research Service, Washington, D. C.

MATHEMATICAL MODELS OF EXCITATION

Yuriy Gur'yevich Antomonov, Alina Borisovna Kotova, Inna Dmitriyevna Ponomareva, Oksana Gavrilovna Pustovoyt, Leonid Vasil'yevich Reshod'ka et al 29 Dec. 1965 153 p refs Transl. into ENGLISH of the book "Matematicheskiye Modeli Vozbuzhdeniya" Kiev, State Publishing House, 1965 p 1–147
(JPRS-33517; TT-65-34091) CFSTI: $4.00

The excitation of nerve and muscular tissue by electrical stimuli is studied with the use of mathematical models. The mathematical models reflect in a general form the regular patterns of tissue excitation and allow a hypothesis concerning qualitative and quantitative characteristics of the response according to a known electrical input signal. Simple mathematics involving functions and differential equations are used in constructing the models. Included are a full treatment on the excitatory properties of an electrical stimulus, physiological research material on threshold properties of nerve and muscular tissue, excitation patterns with various forms of stimuli acting on tissue, an analysis of one of the possible mathematical models of excitation of nervous tissue, and the modeling of excitation properties of nervous tissues on an analog computer. Also included are models of muscular tissue and of various muscular contractions, details of the apparatus used, and an analysis of the frequency factors of nervous tissue functioning. R.N.A.

N66-15004# Joint Publications Research Service, Washington, D. C.

CYBERNETIC APPLICATIONS IN PSYCHOLOGICAL AND MEDICAL PROBLEMS

13 Oct. 1965 65 p refs Transl. into ENGLISH from Vopr. Psikhologii (Moscow), no. 4, 1965 p 75–102, 140–150, 157–164
(JPRS-32365; TT-65-32855) CFSTI: $3.00

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2. MEMORY CAPACITY AND THE AMOUNT OF INFORMATION P. B. Nevel'skiy p 14–31 refs (See N66-15006 05-05)

3. ON THE PROBLEM OF NON-REGULATED ACTIVITY IN CONDITIONS OF PROLONGED ISOLATION WITH SENSORY DEPRIVATION O. N. Kuznetsov and V. I. Lebedev p 32–38 (See N66-15007 05-04)

4. STATISTICAL METHODS OF EVALUATING THE EFFECTIVENESS OF A HUMAN OPERATOR'S TRANSFER FUNCTION G. A. Sergeyev and A. F. Romanenko p 39–52 refs (See N66-15008 05-05)

5. THEORY AND PRACTICE OF MEASUREMENTS OF THE ELECTROENCEPHALOGRAPHIC SIGN CORRELATION COEFFICIENT Ye. Ya. Voytinskiy and V. A. Pryanishnikov p 53–64 refs (See N66-15009 05-04)

N66-15005 Joint Publications Research Service, Washington, D. C.

ON THE ROLE OF EMOTIONS IN THE ADAPTIVE BEHAVIOR OF LIVING SYSTEMS

P. V. Simonov *In its* Cybernetic Appl. in Psychological and Med. Probl. 13 Oct. 1965 p 1–13 refs (See N66-15004 05-04) CFSTI: $3.00

Emotion is considered as a compensatory mechanism offsetting the shortage of information required to accomplish the goal, or to satisfy the need, of the human being. It is assumed that emotion reflects the physiological nature of the phenomenon, reveals the relationship with the need and action, and proves to be universal in nature. It is within this framework that negative emotions, the adaptive significance of positive emotions, and the avoidance of pain are considered. The theory of dynamic stereotype, which shows which physiological mechanisms underlie the formation of activity programs in higher animals, is considered along with disturbances in the stereotype. Characteristics of emotional reactions are enumerated, and it is concluded that emotions are pertinent only when an information shortage exists. As this shortage is eliminated and the new dynamic stereotype is formed, the advantages of emotions are transformed into disadvantages. The classic "information" disease, or neurosis, arises because of emotions; and it is pointed out that psychotherapy is primarily oriented toward eliminating the so-called information shortage. M.W.R.

N66-15007* Joint Publications Research Service, Washington, D. C.

ON THE PROBLEM OF NON-REGULATED ACTIVITY IN CONDITIONS OF PROLONGED ISOLATION WITH SENSORY DEPRIVATION

O. N. Kuznetsov and V. I. Lebedev *In its* Cybernetic Appl. in Psychological and Med. Probl. 13 Oct. 1965 p 32–38 (See N66-15004 05-04) CFSTI: $3.00

Fragments of a story and diary written by two subjects tested in a sound- and light-insulated isolation chamber are presented. Tests to determine neuropsychiatric stability dealt with performance capacity, physiological and mental functioning, sleep, different regimes of work, and relaxation. The fixed program occupied four hours each day; the remaining hours were completely non-regulated for isolation periods of 10 and 15 days. It is noted that at the start of the experiment the subjects prepared themselves for the regulated activity far in advance. As the experiment progressed, they found it difficult to abandon their non-regulated activity and were reluctant to resume the fixed activity part of the program. Free activities mentioned include singing, whistling, writing poetry and fiction, drawing, and wood carving. The subjects even disassembled and replaced parts of the electrophysiological sensors used in the experiment. M.W.R.

N66-15009 Joint Publications Research Service, Washington, D. C.

THEORY AND PRACTICE OF MEASUREMENTS OF THE ELECTROENCEPHALOGRAPHIC SIGN CORRRELATION COEFFICIENT

Ye. Ya. Voytinskiy and V. A. Pryanishnikov *In its* Cybernetic Appl. in Psychological and Med. Probl. 13 Oct. 1965 p 53–64 refs (See N66-15004 05-04) CFSTI: $3.00

A discrete setup is described for the automatic calculation of the sign correlation coefficients of the electroencephalogram signal, and the theory of the sign correlation method is examined. Formulas are derived for error calculations, and it is shown that the measurement error tends to be zero when there are sufficiently long observation intervals. Block and circuit diagrams are included for the sign correlator, which is an electronic setup operating in real time with a high degree of accuracy over a broad range of frequencies. M.W.R.

N66-15038 Joint Publications Research Service, Washington, D. C.

THE DEVELOPMENT OF MICROBIOLOGY

Shu-Ch'un Teng *In its* Transl. on Communist China's Sci. and Tech. 21 Dec. 1965 8 p refs Transl. into ENGLISH from K'O-Hsueh T'ung Pao (Peking), no. 10, Oct. 1965 p 889–891 (See N66-15037 05-34) CFSTI: $2.00

A brief review of the historical development of microbiology as a branch of science is presented. The contributions of Pasteur, Koch, and others are briefly summarized. The development of microbiology was assisted, in varying degrees, by other biological disciplines, chemistry, and physics. In turn, microbiology has enhanced and propagated medicine, other fields of biology, and forestry. The need for collaboration among workers in microbiology, biochemistry, and biophysics is recognized. E.E.B.

N66-15043 Joint Publications Research Service, Washington, D. C.

RADIATION PROTECTION

In its Transl. on Communist China's Sci. and Technol. 6 Dec. 1965 22 p Transl. into ENGLISH from Yuan-Tzu-Neng Ti Yuan-Li Ho Ying-Yung (Peking), Ch. 10, Jul. 1965 p 294–318 (See N66-15042 05-34) CFSTI: $3.00

A brief outline of acute and long range radiation effects on the human system is given, and a variety of preventive and protective methods against radiation contamination are discussed. Human endurance to radiation varies according to health, age, sex, and state of the nervous system; generally, a dose of 100 to 200 rad causes serious radioactive disease. Radiation effects can be reduced by adequate shielding, increased distance from the radiation source, and a decreased time of exposure. Humans working with or near radioactive materials should carry a device that registers radiation exposure; persons with blood deficiencies, tuberculosis, or some types of mental instability should not work with radioactive materials. A personal radiation monitoring device made of film negatives was found most useful for radiation detection of the 0.02-3 r or 0.5 to 20 r ranges. G.G.

N66-15056# Joint Publications Research Service, Washington, D. C.

CHANGES IN RESPIRATION AND REFLEX EXCITABILITY OF THE RESPIRATORY CENTER IN DOGS INHALING OXYGEN

G. A. Vaksleyger and L. F. Yermenko 16 Jun. 1965 14 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR I. M. Sechenova (Leningrad), v. 50, no. 3, Mar. 1964 p 280–287 (JPRS-30637; TT-65-31273) CFSTI: $1.00

Data indicated two phases in the effect of increased oxygen content on respiration. For two to eight minutes after inhalation, respiration became more shallow in 88% of the animals. In 82% of the cases, threshold of reflex excitability remained unchanged. The initial reaction was followed by a delayed response, whereby external respiration approximated its original form. Characteristic respiratory changes were also observed after the administration of chloral hydrate and aminazin. There was weakening of thoracic respiration while abdominal respiration remained relatively unchanged, suggesting inhibition of cerebral cortex activity. However, it was found that aminazin does not alter excitability of the respiratory or feeding centers. Experimentation was carried out in a closed chamber with temperature and pressure constant but ventilation varied. Reflex excitability of the respiratory center was determined by stimulating the trunk of the vagus nerve drawn out in a skin flap on the neck. Length of stimulation was 4 to 10 sec, each stimulation lasting 3 millisec. Immediately after the threshold was determined by minimum coughing effect, oxygen was supplied, then ventilation was stopped, the chamber sealed and the CO_2 was absorbed by a CaO_2 cartridge. M.W.R.

N66-15058# Joint Publications Research Service, Washington, D. C.

STUDIES ON THE EFFECTS OF HEAT, VIBRATIONS, AND RADIATION ON THE ORGANISM

24 Dec. 1964 43 p refs Transl. into ENGLISH from Fiziol. Zh. Akad. Nauk Ukr. RSR (Kiev), v. 10, no. 5, Sep.–Oct. 1964 (JPRS-27982; TT-64-51997) CFSTI: $2.00

The following studies are presented: "Effect of High-Frequency Electromagnetic Vibrations on the Motor Function of the Human Stomach"; "Effect of Blood Circulation on the Distribution of Heat and the Magnitude of the Thermal Effect During Action of a Superhigh-Frequency Electromagnetic Field on Animals"; "Participation of the Central and Vegetative Nervous System in the Mechanism of Ultrasonic Action on the Absorptive Processes in the Gastrointestinal Tract"; "Effect of X-Ray Irradiation on the Structure of DNA Molecules in Solution"; and "Body Temperature and Heat Generation in White Rats Under the Effect of Radial Acceleration." G.G.

N66-15071*# IIT Research Inst., Chicago, Ill.

LIFE IN EXTRATERRESTRIAL ENVIRONMENTS Quarterly Status Report, 15 Aug.–15 Nov. 1965

Charles A. Hagen [1965] 17 p ref

(Contract NASr-22)

(NASA-CR-69141; IITRI-L6023-3) CFSTI: HC $1.00/MF $0.50 CSCL 06F

Bacillus cereus spores were exposed to either 100° C or 130° C for as long as 30 min and found not remarkably sensitive to a modified Martian environment with diurnal freezing and thawing cycles. Although vegetative cell growth and sporulation were delayed, population densities after 28 days of exposure compared favorably with previous results from nonheated spores. Exposure of B. cereus and B. subtilis spores to a simulated Martian environment with barometric pressures over the 5 mm to 12 mm Hg range indicated that the growth response was unusually delayed or inhibited when compared to the growth response of these organisms in a similar environment but with a pressure of 75 mm Hg. Manometric studies were initiated to determine the extent of adaptation and/or damage that an organism's respiratory system undergoes as a result of prolonged contact with a simulated extraterrestrial environment. Determination of suitable systems were investigated and included phosphate buffer and glucose concentrations, the effect of 1-alanine and manganese sulfate as germinating agents, and different densities of B. cereus and B. subtilis spore suspensions. C.T.C.

N66-15081# Montefiore Hospital, New York.

EFFECT OF COLLIMATOR-SHAPE ON DEPTH DOSE CURVES.

A. Dahler (Norweg. Radium Hosp.) [1964] 9 p Presented at the Symp. of High Energy Electrons, Montreux, Switzerland, Sep. 1964

(Contract AT(30-1)-2607)

(CONF-640918-1) CFSTI: HC $1.00/MF $0.50

A comparison was made of isodose and depth-dose curves for 15-, 25-, and 33-Mev electrons when Cr-plated brass or perspex applicators were used as part of the collimating system. Results indicated that the brass applicators gave a more ideal isodose curve at depths. Design improvements are suggested to increase the performance of collimators used in radiotherapy. NSA

N66-15117 Catholic Univ. of America, Washington, D. C. Dept. of Electrical Engineering.

AUTOCORRELATION TECHNIQUES APPLIED TO THE FETAL HEART SIGNAL

Andrew G. Favret *In its* Elec. Eng. Res. Rev., No. 4 Jun. 1965 p 36–45 refs (See N66-15112 05-34)

(Grant PHS-HE-06268)

The effectiveness of autocorrelation techniques when applied to the fetal heart signal analysis was evaluated. The correlation analysis was performed on a digital computer which permitted considerable flexibility in manipulating the data and adjusting the correlation parameters. In the fetal electrocardiogram, the maternal complex dominates the correlogram and prevents a meaningful interpretation of the fetal contribution. Before correlation analysis, the maternal signal is automatically eliminated in the computer by locating the sharp maternal peaks, shifting each maternal cycle in time so that all peaks are aligned, developing group averages for the maternal complex, and subtracting the appropriate average maternal complex from each maternal cycle in the original data. This technique is shown graphically. Even with the maternal complex removed, autocorrelation analysis does not provide improved detection performance over conventional visual analysis. This is due to the not quite periodic nature of most fetal signals combined with the specific type of waveshape associated with the fetal electrocardiogram. R.N.A.

N66-15118 Catholic Univ. of America, Washington, D. C. Dept. of Electrical Engineering.

MATCHED-FILTER PROCESSING OF FETAL ELECTROCARDIOGRAMS

William A. Welch *In its* Elec. Eng. Res. Rev., No. 4 Jun. 1965 p 46–56 (See N66-15112 05-34)

This paper reports the results of an investigation to improve the probability of detection of fetal signals by using matched filters and applying the concepts of statistical decision theory. Since the signals were recorded on magnetic tape, a digital computer was used to simulate the matched filter and perform the decision theoretical analysis. The study shows that matched filter processing of fetal electrocardiograms is capable of offering significant improvement over simple peak detection. This result was demonstrated for an electrocardiogram with high fetal signal-to-noise ratio, i.e., the positions of the fetal peaks were known in advance. Since the actual purpose of the program is to detect fetal peaks when their positions are not already known, it will be necessary to process electrocardiograms with poor signal-to-noise ratios before the effectiveness of matched filter computer processing can be completely determined. R.N.A.

N66-15129# Joint Publications Research Service, Washington, D. C.

VESTNIK OF THE USSR ACADEMY OF MEDICAL SCIENCES, VOLUME XX, NO. 9, 1965

7 Dec. 1965 195 p refs Transl. into ENGLISH of Vestnik. Akad. Med. Nauk SSSR (Moscow), v. XX, no. 9, 1965 p 1–111 (JPRS-33196; TT-65-33772) CFSTI: $5.00

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N66-15130 Joint Publications Research Service, Washington, D. C.

PATHOGENESIS OF REMOTE CONSEQUENCES OF RADIATION

S. N. Aleksandrov *In its* Vestn. of the USSR Acad. of Med. Sci. 7 Dec. 1965 p 12–15 (See N66-15129 05-04) CFSTI: $5.00

Results of a study to investigate disturbances which develop in irradiated subjects surviving acute or chronic radiation sickness are presented. Three types of disturbances are singled out and discussed: (1) irreplaceable loss of cellular modification; (2) disorders preserved in irradiated cells, and (3) hereditary changes in somatic cells. These derangements were found to cause variations in body reactivity which limits defensive and adaptive possibilities in the irradiated organism. Such a biological "chain reaction" results in shortening of the life span and represents injury or disease occurring after subsequent exposure of the organism to radiation effects. M.R.W.

N66-15131 Joint Publications Research Service, Washington, D. C.

BIOLOGICAL ANALYSIS OF PRIMARY BIOLOGICAL RADIATION EFFECTS

N. V. Luchnik *In its* Vestn. of the USSR Acad. of Med. Sci. 7 Dec. 1965 p 16–22 refs (See N66-15129 05-04) CFSTI: $5.00

The paper presents a brief essay on the present-day situation with regard to the issue of primary mechanisms underlying the biological action of radiation. New data on the nature of primary chromosome injuries, on occult injuries of the DNA molecules and on the significance of free-radicals mechanisms are cited. The obtained results are discussed from the standpoint of their significance for certain problems of radiobiology and medical radiology. Author

N66-15132 Joint Publications Research Service, Washington, D. C.

MOLECULAR MECHANISMS UNDERLYING RADIATION CYTOGENETIC DISTURBANCES

B. V. Ivannik, N. A. Klipson, T. G. Mamedova, N. I. Ryabchenko, M. V. Sklobovskaya et al *In its* Vestn. of the USSR Acad. of Med. Sci. 7 Dec. 1965 p 23–28 refs (See N66-15129 05-04) CFSTI: $5.00

Results are reported of an experimental study of the damaging effect of different forms of free radicals and of irradiation on the cellular and molecular levels, and also of the nature of various types of local injuries arising in macromolecules of DNA and DNP. The damages appearing in the basic matrix structure of the cellular nucleus, provoked by the effect of ionizing radiation, are demonstrated to be secondary to direct absorption of radiation energy of them. These damages cannot be fully imitated by the action of free radicals, or by ultraviolet radiation. Author

N66-15133 Joint Publications Research Service, Washington, D. C.

ON PROCEDURES FOR RECORDING AND ASSESSING DYNAMICALLY THE FREQUENCY OF DEVELOPMENTAL DEFECTS IN MAN

N. V. Glotov *In its* Vestn. of the USSR Acad. of Med. Sci. 7 Dec. 1965 p 29–33 refs (See N66-15129 05-04) CFSTI: $5.00

The author depicts methodological requirements which have to be taken into consideration in analysing the frequency of developmental defects. Under consideration are the influence exerted by the migration of the population, diagnostic particularities and the actual state of medical statistics on the results subsequent to estimates of the developmental defects frequency. An analysis of some literature data concerning temporal dynamics of developmental defects is given. Note is taken of the ambiguous inferences and the absence of convincing facts speaking in favor of a systematic rise in the frequency of developmental defects. Author

N66-15134 Joint Publications Research Service, Washington, D. C.

A STUDY OF PROCESSES GOVERNING THE REPAIR OF CELLS FROM PRIMARY CYTOGENETIC INJURIES

L. S. Tsarapkin, N. A. Poryadkova, N. G. Labzina, S. I. Alekseyeva, and V. S. Yatenko *In its* Vestn. of the USSR Acad. of Med. Sci. 7 Dec. 1965 p 34–44 refs (See N66-15129 05-04) CFSTI: $5.00

Experimental data are set forth demonstrating the influence exerted by gamma-irradiation on the character of the chromosome formation from the chromatid. A phenomenological classification of effective chemical substances, tested according to a definite pattern and capable of producing a defensive or radiosensitizing effect on the cytogenetic level, is presented. Author

N66-15135 Joint Publications Research Service, Washington, D. C.

ENERGY-PRODUCING PROCESSES AND THE POST-RADIATION REPAIR OF THE CELL

A. F. Mosin, R. P. Ivanova, and E. M. Karabayev *In its* Vestn. of the USSR Acad. of Med. Sci. 7 Dec. 1965 p 57-62 refs (See N66-15129 05-04) CFSTI: $5.00

Restoration of post-radiation damages of cells is closely related to the activity of energy-producing processes (respiration and fermentation). The suppression of these processes tends to inhibit the restoration. In irradiated yeast the respiratory intensity is much higher than in nonirradiated one. As the irradiation dose increases the rate of oxygen consumption goes up too. This, however, is seen to occur only in strains capable of post-radiation restoration. In cells devoid of this ability (haploids) the nature of respiration after irradiation remains unchanged. Under definite conditions (cellular concentration in a suspension not exceeding 5×10^6 cell/ml and the presence of substrate) fermentation provides just as high a level of restoration as does the respiration. In thick suspensions under anaerobic conditions the restoration is strongly inhibited, and this in spite of the presence of a sufficiently large amount of glucose. In these conditions it is alcohol that appears as a factor hindering the process of restoration. Author

N66-15136 Joint Publications Research Service, Washington, D. C.

REACTIONS OF THE NEUROSECRETORY NUCLEI OF THE HYPOTHALAMUS, THYROID GLAND AND ADRENALS IN THE CASE OF IRRADIATION INJURY TO THE BODY

A. A. Voytkevich, A. V. Tkachev, A. S. Chekunov, G. F. Palyga, and G. A. Ovchinnikova *In its* Vestn. of the USSR Acad. of Med. Sci. 7 Dec. 1965 p 63–75 refs (See N66-15129 05-04) CFSTI: $5.00

The authors used histochemical, histological and histoautographic techniques in studying the nature marking distribution and content of typrosine, tryptophan and histidine, the activity of the succino-dehydrogenase, the localization of the polonium-210 alpha-particles, the number of chromosomic aberrations in the liver and also the histostructure of neurosecretory nuclei of the hypothalamus, thyroid gland and adrenals in different functional states and in radiation sickness induced by external gamma-irradiation and introduction of polonium-210. The experiments were staged on rats of the Wistar and August lines, as well as on mongrels. The introduction of hormonal preparations to animals and radiation injury of the organism bring about substantial changes in the endocrine organs, which proves the neuroendocrine system to partake in the response of the organism to various adequate and nonadequate effects. Thus, the neurosecretory hypothalamus nuclei cells, which are a seat for an elective accumulation of Po^{210}, after provisional deposition of neurosecretion, demonstrate an intensive discharge of the latter, followed by cellular destruction. Alterations occurring in the thyroid and adrenals are also of a triphasic nature. After a short period of stimulation comes the stage of functional depression of the above-cited glands. Later on, morphological signs denoting stimulation of the thyroid and adrenals become apparent. Under discussion is the nature of disturbances of the neuroendocrine system regulatory components appearing under the effect of radiation factors. Author

N66-15137 Joint Publications Research Service, Washington, D. C.

TRANSPLANTABLE FIBROSARCOMA IN LINEAGE RATS, INDUCED BY PLASTICIZED RESIN AND Co^{60} GAMMA IRRADIATION

S. P. Podsosov and S. I. Kharlampovich *In its* Vestn. of the USSR Acad. of Med. Sci. 7 Dec. 1965 p 76–81 refs (See N66-15129 05-04) CFSTI: $5.00

By combining the inducing capacity of plastisized resin and carcinogenous effect of a high dose of Co^{60} gamma-irradiation the author obtained a primary tumor (fibrosarcoma). The further transplantation of the tumor (10 generations) was effected simultaneously on two groups of animals:—irradiated and nonirradiated. In groups of irradiated and nonirradiated rats of the "August" line a difference was established in the duration of the latent period, life span, volume, weight and microscopic picture of the growing neoplasm. Author

N66-15138 Joint Publications Research Service, Washington, D. C.

ON THE LOSS OF HYPOTENSIVE ACTIVITY DUE TO DERIVATIVES OF 5-HYDROXY-INDOLE DURING IRRADIATION OF ANIMALS

A. N. Grinev, T. Yu. Il'yuchenok, V. P. Lepekhin, and K. S. Shadurskiy *In its* Vestn. of the USSR Acad. of Med. Sci. 7 Dec. 1965 p 82–86 refs (See N66-15129 05-04) CFSTI: $5.00

Experiments made on rats of the "August line demonstrated that some 5-hydroxy-indole derivatives produce a chronic hypotensive action (from 66 up to 77 days). A preliminary exposure of rats to irradiation in a dose of 300 roentgens results in the reduction of the hypotensive effect, while in a dose of 6000 roentgens no hypotensive action is seen at all (compound ORF-50). It is suggested that irradiation of the animals brings with it "break-up" of biochemical mechanisms, through which 5-hydroxyindoles are involved in the hypotensive effect. Author

N66-15139 Joint Publications Research Service, Washington, D. C.

ACCUMULATION AND EXCRETION KINETICS OF RADIOACTIVE CESIUM (Cs^{137}) UPON ENTRY INTO THE ORGANS OF RESPIRATION

G. K. Korolev *In its* Vestn. of the USSR Acad. of Med. Sci. 7 Dec. 1965 p 87–96 refs (See N66-15129 05-04) CFSTI: $5.00

Distribution of $Cesium^{137}$ in albino rats following its intratracheal introduction was studied. Radiometric investigations demonstrated this radio-isotope to be highly absorbable. In the course of the first 24 hours up to 90% of the activity introduced (0.4 microcuries/g of the animal's body weight) is removed from the lungs. The absorption of the radio element proceeds exponentially. $Cesium^{137}$ penetrating into the organism is deposited predominantly in muscles (about 46% of the activity actually introduced). The isotope is noted to metabolize at a higher rate in the myocardium. It is also deposited in the skeleton, liver and in other organs. Within the limits of 24 hours the concentration of the isotope was highest in the kidneys. Later on, no essential differences were noted in the level of the isotope contained in 1 g of the internal organs. Morphological examinations of the lungs revealed the occurence of massive hemorrhages and the development of degenerative and inflammatory processes. After expiration of 15 days regenerative processes made their appearance, becoming most marked in 2–3 months. Within the period of from 4 to 12 months one could see an increased microcellular infiltration setting in around vessels and proliferation of the connective tissue. Author

N66-15140 Joint Publications Research Service, Washington, D. C.

SOME PROBLEMS OF IMMUNOPATHOLOGY UPON CHRONIC EXPOSURE OF THE BODY TO RADIOACTIVE ZINC (Zn^{65})

P. P. Filatov and Ye. S. Gaydova *In its* Vestn. of the USSR Acad. of Med. Sci. 7 Dec. 1965 p 97–105 refs (See N66-15129 05-04) CFSTI: $5.00

The work deals with a study of the role played by autoimmunological processes in animals exposed chronically to the effect of radioactive zink (Zn^{65}). By using immunological, morphological and biochemical techniques it was shown that under prolonged effect of Zn^{65} the antigenic tissue structure in laboratory animals is subject to alterations, there appear autoantibodies and the fraction composition of the blood serum changes too. There was also evidence of the reticular tissue hyperplasia in hemopoietic organs, the emergence of extramedullary hemopoiesis foci in the spleen and lymphatic nodes and the presence of plasmatic cells, amyloidosis in the spleen and kidneys. The confrontation of the resulting data gives ground to suggest that autoimmunological mechanisms play an important role in the pathogenesis of a chronic radiation injury. Author

N66-15141 Joint Publications Research Service, Washington, D. C.

COAGULATION OF THE BLOOD AND ITS FIBRINOLYTIC ACTIVITY IN ACUTE RADIATION SICKNESS

V. P. Baluda, N. V. Lysogorov, S. S. Khnychev, D. N. Ishmukhametova, Zh. N. Rukazenkova et al *In its* Vestn. of the USSR Acad. of Med. Sci. 7 Dec. 1965 p 106–111 refs (See N66-15129 05-04) CFSTI: $5.00

The work is devoted to clarifying the condition of the coagulation and fibrinolytic systems of the blood in acute radiation sickness induced by gamma-rays. A whole-body irradiation with Co^{60} in a dose of 600 rads at a dosage rate of 100 rad/sec during acute period of acute radiation sickness produces delayed coagulation of the blood, reduced tolerance of plasma to heparin, diminished prothrombin activity of the blood, increased thrombin time and fibrinogen concentration, reduced thermal stability, the emergence of fibrinogen B, reduced fibrinase and fibrinolytic activities, diminished blood platelets count and disturbed retraction of the blood clot. The electron microscopy demonstrated upset structure of the fibrin fibers, rupture of the fibrin threads and their vacuolization. The hemorrhagic syndrome is seen to make its appearance 24 hours after irradiation (occult blood in the feces), with its most marked manifestations emerging at the height of the disease. Disturbances in the properties and structure of the fibrin clot during radiation sickness are primarily due to reduced fibrinase activity. Disordered coagulation of the blood and fibrinolase in radiation sickness may cause functional and morphological alterations in vascular walls and bleeding. Author

N66-15142 Joint Publications Research Service, Washington, D. C.

THERMAL AND ANAPHYLACTOID EDEMA IN ACUTE RADIATION SICKNESS

V. M. Dorofeyev, B. V. Polushkin, and N. I. Tsyran *In its* Vestn. of the USSR Acad. of Med. Sci. 7 Dec. 1965 p 119–127 refs (See N66-15129 05-04) CFSTI: $5.00

The authors investigated in rats of the Wistar line the size of edema on a thermally damaged skin of their paws and following subcutaneous injection of dextran. The part played by serotonin in the development of edema in healthy and gamma-irradiated rats (doses of 750 and 680 rads) was demonstrated. In acute radiation sickness the rats showed inhibition of the thermal and anaphylactoid edema, this being particularly evident on the 4th day after irradiation. By the 8th day the intensity of the edema would return back closely to its normal level, while the blood serotonin experienced a sharp drop. Preliminary administration of iprazide, indopan, 5-oxytryptophan and serotonin inhibits the development of a thermal edema in healthy rats. 5-oxytryptophan tends to raise the serotonin concentration in the blood and does so particularly in the skin of rats with acute radiation sickness. It also depresses the development of a thermal edema. Iprazide stimulates a dextran-induced edema in irradiated rats, but tends to inhibit a thermal one. Author

N66-15143 Joint Publications Research Service, Washington, D. C.

EFFECT OF ZYMOSAN UPON THE MACROPHAGE RESPONSE OF THE LUNGS AND PHAGOCYTOSIS IN ACUTE RADIATION SICKNESS

A. V. Bykhovskiy, G. S. Komovnikov, and B. V. Polushkin *In its* Vestn. of the USSR Acad. of Med. Sci. 7 Dec. 1965 p 128–133 refs (See N66-15129 05-04) CFSTI: $5.00

The modified technique of La Belle and Brieger, which includes cytological examination of the pulmonary wash off permits obtaining readily reproducible results, characterizing accumulation of alveolar macrophages in air passages of the lungs. Intratracheal administration of zymosan to nonirradiated rats causes a considerable increase of alveolar macrophages in the pulmonary wash off (27-fold in 22 hours after introduction of 1500 γg of zymozan). As compared with intratracheal administration of carbon, ornithine and aminoacetic acid-zymozan showed the most marked stimulating effect. With intraperitoneal administration of zymozan no substantial changes in the number of alveolar macrophages is recorded. Intraperitoneal injections of zymozan in irradiated and nonirradiated rats caused stimulation of the bone-marrow function, leukocytosis and increased phagocytic activity of cellular elements in the lungs and blood. The changes occurring in the digestive capacity of cellular elements and the blood are of an undulating nature. Author

N66-15144 Joint Publications Research Service, Washington, D. C.

CHANGES IN THE COMPOSITION OF SERUM PROTEINS IN IRRADIATION INJURIES OF ANIMALS

K. P. Kashkin and S. V. Aleksandrova *In its* Vestn. of the USSR Acad. of Med. Sci. 7 Dec. 1965 p 145–149 refs (See N66-15129 05-04) CFSTI: $5.00

The presented material was derived from immunochemical and biochemical investigations into serum proteins of irradiated animals. As an object of research served nonlineage mice, subjected to roentgen irradiation with a dose of 1000 rads, and also rats of the "August" line and monkeys (Macaca-rhesus), exposed to the effect of Co^{60} gamma-rays in doses of 630–750 and 550–630 roentgens respectively. Highly sensitive rabbit antisera were used in analysis. The radiation injury was demonstrated to lead to qualitative and quantitative alterations in the composition of individual serum protein fractions, which are due to varying sensitivity to irradiation of the cells participating in their synthesis. Evidence was also obtained showing that following radiation injury some tissue antigens gain access into the blood of irradiated animals, which are absent in the serum of intact animals. Author

N66-15145 Joint Publications Research Service, Washington, D. C.

A CIRCULATORY RADIOCARDIOGRAPHIC METHOD FOR COMPLEX ANALYSIS OF CENTRAL AND PERIPHERAL HEMODYNAMICS

B. Ye. Votchal and F. F. Vysovskiy *In its* Vestn. of the USSR Acad. of Med. Sci. 7 Dec. 1965 p 150–163 refs (See N66-15129 05-04) CFSTI: $5.00

Inhalation radiocardiography with radioactive krypton (Kr^{35}) was taken as a basis for establishing a technique for the study of the central and peripheral hemodynamics constants. Under examination came healthy persons, patients with predominant sinistro-ventricular and dextroventricular insufficiency and with liver cirrhosis. The analysis of the obtained data indicates the presence of a fine differentiation of the indices covering the central hemodynamics of the arterial and venous circulation, as well as the liver circulation in healthy persons and in patients demonstrating different pathological conditions. Author

N66-15150# National Defense Research Organization T.N.O., The Hague (Netherlands). Medical Biological Lab.

THE CULTURE COLLECTION OF THE DEPARTMENT FOR MICROBIAL GENETICS. II: THERMOSENSITIVE MUTANTS OF *ESCHERICHIA COLI*

A. Rörsch, P. van de Putte, I. M. Dijkmans, J. van Dillewijn, and A. M. Schepman Sep. 1965 39 p refs (MBL/1965/25) CFSTI: HC $2.00/MF $0.50

Thermosensitive microbial mutants were isolated by various techniques, and some of the properties of the mutants are listed. The growth curves for all the 350 mutants isolated, are presented, and the conditions of growth measurement are given. The properties of the various types of mutants isolated are summarized in a model growth curve. According to their growth pattern at 42° C, the mutants were classified in the following four categories: a) strains blocked in cell division forming long filaments (fts strains), b) strains that do not grow

at all at elevated temperature (gts strains), c) strains that lyse at 42° C (lts strains), and d) strains of which the nature of the thermosensitive mutation is unknown as yet (uts strains).
L.S.

N66-15152 Joint Publications Research Service, Washington, D. C.
THE DEVELOPMENT OF MOLECULAR BIOLOGY
T'ien-Ch'in Ts'ao and Te-Pao Wang *In its* Transl. on Communist China's Sci. and Technol., No. 274 5 Jan. 1966 p 1–12 (See N66-15151 05-34) CFSTI: $3.00

History, status, and practical significance of molecular biology are reviewed in general terms. Discussed are two biological milestones: (1) clarification of protein structure and synthesis and (2) transmission of genetic information. Included are stereo structure models of whale myoglobin and horse hemoglobin, the double helical structure of deoxyribonucleic acid, and a diagram of protein biosynthesis. Contributions of molecular biology to other scientific disciplines are mentioned.
M.W.R.

N66-15156 Joint Publications Research Service, Washington, D. C.
ENTOMOPHILIC MICROORGANISMS AND THEIR USES
Hsing Tsang *In its* Transl. on Communist China's Sci. and Technol., No. 274 5 Jan. 1966 p 31–41 refs (See N66-15151 05-34) CFSTI: $3.00

Utilization of bacteria, fungi, viruses, and protozoans for insect control is considered for agricultural production programs. In China, a bacillus-containing powder has been found effective against pine, cabbage, and tea moths as well as fruit tree borers. Certain fungi have been used in soybean fields and in silk production. Further studies are required to determine the location and season for spraying fungi-preventive powder, and unified production methods must be developed for the various powders. Virus-containing powders have not been developed, but studies have been made of viruses in the silkworm and attempts have been made to isolate certain viruses.
M.W.R.

N66-15158 Joint Publications Research Service, Washington, D. C.
EFFECT OF IMMUNIZATION SERUM ON PHAGOCYTES, BACTERICIDINS, AND CELL METABOLISM
Ting Fang, Hui-Fen Wang, and Mei-K'un Su *In its* Transl. on Communist China's Sci. and Technol., No. 274 5 Jan. 1966 p 58–63 refs (See N66-15151 05-34) CFSTI: $3.00

Under normal conditions, phagocytic ability of the polynuclear cells of immunized domestic chinchilla rabbits is very weak in the presence of poisonous typhoid bacillus of mice. Under special conditions the phagocytes may become active and counteract the bacilli. Experiments indicate a relationship between increase in phagocytic and bactericidal action, oxygen consumption of the phagocytic cells, and increased accumulation of lactic acid. Tables summarize data on the effect of immunization serum on phagocytic percentage of polynuclear cells, lactic production in these cells, relationship between lactic acid production of control and immunized cells, oxygen consumption, and bactericidal activity. It is concluded that when phagocytic activity increases, metabolism takes place at a higher energy level.
M.W.R.

N66-15197# Joint Publications Research Service, Washington, D. C.
CYBERNETICS IN CLINICAL MEDICINE
A. S. Cheyshvili 27 Dec. 1965 93 p refs Transl. into ENGLISH of the book "Kibernetika v Klinicheskoy Meditsine" USSR, Sabchota Sakartvelo, 1964 p 1–92
(JPRS-33477; TT-65-34051) CFSTI: $3.00

The work examines from the standpoint of biological cybernetics the processes of control over the functional activity of the organism as well as the intrasystemic mechanisms in the interaction between the organism and environmental factors in health and disease. The following problems are considered: the significance of control processes and interconnections with respect to the methodological foundations of the science of cybernetics which is of practical importance to medicine; the problem of adaptation of the organism; the principles of automatism and self-regulation of functional activity over the closed circuits through which the impulses travel and processing of information through them. The working activity of the organism is illustrated with the aid of original block diagrams clarifying the dynamics of the processes. The concluding part presents the applications of the cybernetic method to the problems of practical medicine, with certain typical pathological states being examined.
Author

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N66-14343# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
TRAINING FOR GROUP INTERDEPENDENCE
Donald B. Haines Jul. 1965 25 p refs
(AMRL-TR-65-117; AD-623119) CFSTI: HC $2.00/MF $0.50

Small teams and crews working together in intimate coordination are the key to many USAF missions today and effective team performance may depend upon member interdependency within the group. An adequate training program requires understanding of the ways in which men work together in closely-knit groups. Goal and means interdependency in group process has long been a focus of interest for social psychologists. Current research and theory thus may provide useful guidelines for applications of group interdependency principles to military crew situations (particularly that of the American military advisor working with his foreign counterpart). The concepts of goal and means interdependency are defined, the controversy between current exponents of cognitive and stimulus-response (S-R) theory is examined for its contribution to understanding group interdependency phenomena, the recent adaptation of the theory of games is reviewed, and suggestions are made for the development of experimental training programs which will furnish insights into the nature of group functioning.
Author (TAB)

N66-14400# Lockheed Missiles and Space Co., Sunnyvale, Calif.
WEIGHTLESSNESS SIMULATION USING WATER IMMERSION TECHNIQUES Annotated Bibliography, 1951–Jul. 1965
Helen M. Abbott and John H. Duddy, comp. Jul. 1965 54 p refs
(LMSC-5-24-65-3; SB-65-2; AD-623163) CFSTI: HC $3.00/MF $0.50

The compilation contains 97 selected references pertaining to biomedical and behavioral research involving immersion of human subjects. The references are organized under three principal topics: (1) Physiological Studies, including acceleration, impact protection and physiological responses to weightlessness simulations, (2) Human Engineering Studies, and (3) Techniques and Personal Equipment Requirements for immersion studies. The references are arranged alphabetically by author or title

under each separate topic. An Author Index is included as an aid in locating specific investigators and publications. The references cited are considered to be the principal contributions to the literature during the period from 1951 through 1965, including both open and government sources. Author (TAB)

N66-14435# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
APPLICATION OF BEHAVIORAL SCIENCE TO PERFORMANCE AID DEVELOPMENT
Donald A. Topmiller Aug. 1965 17 p refs
(AMRL-TR-65-146; AD-623619) CFSTI: HC $1.00/MF $0.50

Four classes of variables relevant to behavioral research on the development of performance aids (technical orders, maintenance manuals, etc.) are outlined: (a) Legibility and Format Variables; (b) Variables Associated with Processing Printed Numeric Information; (c) Variables Associated with the Physical Configuration of Performance Aids; and, (d) Variables Associated with Troubleshooting Informational Processing and Display Systems. Each of these topics is discussed within a historical framework, with supporting empirical research. Some predictions are made for future trends in performance-aid behavioral studies. Author (TAB)

N66-14450# Yale Univ., New Haven, Conn. Dept. of Biology.
SYSTEMS ANALYSIS AND VISUAL ORIENTATION OF ANIMALS
Talbot H. Waterman 1965 48 p refs Submitted for Publication

Current research is reviewed on visual responses in aquatic animals which respond strongly to linear polarization. Some research was done with insects and cephalopods, but crustaceans were primarily used. Three different approaches to the problem were used: electrophysiological study of visual information processing in large decapod crustaceans, study of phototactic responses to linear polarized light, and fine structure analysis of the light receptor and nervous elements involved in the sensing and processing of visual information in an effort to understand the relation between input and output. R.N.A.

N66-14476# Army Aviation Test Activity, Edwards AFB, Calif.
PRELIMINARY PILOT QUALITATIVE EVALUATION OF THE XV-5A RESEARCH AIRCRAFT Letter Report
Karl H. Zornig [1965] 48 p
(AD-623514) CFSTI: HC $2.00/MF $0.50

The primary objective of the tests was to investigate those aircraft characteristics directly influenced by the Lift-Fan concept. The report contains the results of the preliminary pilot evaluation of the XV-5A aircraft during the stability and control portion of the U.S. Army flight test program. TAB

N66-14498# Joint Publications Research Service, Washington, D. C.
SIMULATING CERTAIN PROPERTIEES OF THE MEMORY
E. T. Golovan', A. N. Luk, and V. S. Starinets 13 Dec. 1965 12 p Transl. into ENGLISH from Priroda (Moscow), no. 9, 1965 p 45-60
(JPRS-33298; TT-65-33873) CFSTI: $1.00

Relative to the development of memory address systems, clarification is given to physiological conditions which allow humans to make arbitrary selections of the necessary facts from his memory. The processes by which man reproduces information are discussed, with emphasis placed on the following areas: the role of associations, in particular, value of associations, their structure, and heirarchic organization; the value of logical transformations which are realized in associative memory; the role of information coding; the significance of the time axis in organization of the bulk of the memory, making it possible to establish relationships of priority, simultaneity, and sequence; and the role of feedback in the process of information reproduction. C.T.C.

N66-14506# Navy Experimental Diving Unit, Washington, D. C.
CALCULATION OF DECOMPRESSION SCHEDULES FOR NITROGEN-OXYGEN AND HELIUM-OXYGEN DIVES
Robert D. Workman 26 May 1965 40 p refs
(PR-6-65; AD-620879) CFSTI: HC $2.00/MF $0.50

This report presents the theoretical basis for calculation of decompression schedules for nitrogen-oxygen and helium-oxygen mixtures used in diving. It includes definitions, theory of of exponential saturation and desaturation, and theory of limiting values of excess saturation permitted at various ambient pressures with helium and nitrogen. An attempt has been made to simplify the presentation of the calculation procedure to implement the theoretical method. The necessary tables and worksheets used in calculations are presented, together with sample calculations of dive schedules. The discussion describes and appraises other methods of calculation developed in recent years. Author (TAB)

N66-14544# Dunlap and Associates, Inc., Santa Monica, Calif. Western Div.
TIME AND ACCURACY AS MEASURES OF HUMAN PERFORMANCE: A CRITICAL REVIEW OF THE LITERATURE
R. L. Smith Sep. 1965 26 p refs
(Contract Nonr-4314(00))
(AD-623637) CFSTI: HC $1.00/MF $0.50

The paper presents a review of the literature related to the performance of simple sensory and/or sensory-motor activities in terms of two factors: the optimal time to perform such activities, and the degradation in accuracy, if any, under time stress. The purpose of this literature review was to seek findings which (1) could aid in evaluating the validity, utility and generalizability of existing mathematical models intended to derive personnel performance standards from system effectiveness requirements, and (2) would provide the information for: (a) accurately deriving personnel performance standards in terms of time, and (b) evaluating the possible effect on system effectiveness of varying time constraints. Author (TAB)

N66-14556*# Northrop Corp., Hawthorne, Calif. Space Labs.
TECHNOLOGY STUDY OF PASSIVE CONTROL OF HUMIDITY IN SPACE SUITS
Arnold P. Shlosinger, Wilton Woo, Constantino Cafaro, and Emil W. Bentilla Sep. 1965 79 p refs
(Contract NAS2-2102)
(NASA-CR-69098; NSL-65-87-3) CFSTI: HC $3.00/MF $0.75 CSCL 06K

Two basic techniques for passive humidity control are discussed: (1) condensation of water vapor from a stagnant pressurization gas in the space suit on wicks cooled below the required dew point, and retention or transport of the liquid condensate by wicks; and (2) adsorption of the water vapor by desiccants. An analytical study is also presented of molecular diffusion, mass transfer within an adsorption bed, and condensation on a cooled wick. Tests on several wick materials indicated that wicks of glass fiber and Refrasil provide superior performance for space suit passive humidity control applications; this applies to water transport capability in a horizontal plane (simulated zero G) as well as to vertical water lift capability. Experimental findings confirmed that the applicability of desiccants is limited by high weight penalty and by

difficult regeneration procedures. However, desiccants may be useful in specific applications where the advantage of operation at temperatures higher than the required dew point is significant. The feasibility of using heat sinks of organic material with suitable melt point to provide sensible heat control for periods of 30 minutes to one hour was also demonstrated. M.G.J.

N66-14596# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN ANALYSIS OF THE INERTIAL PROPERTIES AND PERFORMANCE OF THE ASTRONAUT MANEUVERING SYSTEM
Julius Anthony Tieber and Robert Walter Lindemuth (M.S. Thesis) Aug. 1965 266 p refs
(GA/PH/65-4; AD-622443) CFSTI: HC $6.00/MF $1.25

To predict the system performance in space, the inertial properties of the Astronaut Maneuvering System (AMS) were determined. An existing mathematical model of the human body was revised and improved on the basis of improved regression equations and additional anthropometric dimensions. A mathematical model of a space suit was designed on the basis of measurements of suited subjects and suit weight regression equations. These models were combined into a model of a suited body. A computer program calculated the inertial properties of this model and compared them with experimental data. Results indicated the following: (1) Horizontal accelerations are more efficient than vertical accelerations; (2) The effects of inertial cross-coupling cause considerable loss of efficiency in roll and yaw maneuvers; (3) System performance is better with smaller astronauts, not just because of inherently higher accelerations, but also higher efficiency factors; (4) Variations in attitude deadband width have no significant effect on performance; (5) Inertial cross-coupling and center of gravity and line-of-thrust misalignment will make attitude control difficult while performing maneuvers in the manual control mode. Author (TAB)

N66-14651# Library of Congress, Washington, D. C. Aerospace Technology Div.
LIFE SUPPORT SYSTEMS—PHOTOSYNTHESIS Surveys of Soviet Scientific and Technical Literature
Boris Nartsissov 7 Dec. 1965 87 p refs
(ATD-65-107)

A brief comprehensive survey of the literature published in Soviet periodicals during 1964, and an annotated bibliography which supports the survey and is arranged to follow the narrative sequence of the survey is reported. The attention of the Soviet scientist was focused on the following main points of interest: (1) investigation of closely packed chlorophyll modifications in model systems; (2) light conservation, energy transfer, photoexcitation of triplet states in tetrapyrrol pigments; (3) intermediate reduced and oxidized forms of tetrapyrrol pigments; (4) evolution of oxygen in photosynthesis; (5) investigation of the structure of tetrapyrrol pigments; and (6) summaries of scientific meetings. R.W.H.

N66-14656# Joint Publications Research Service, Washington, D. C.
HYPNOPEDIA, ITS LIMITS AND POSSIBILITIES, TRUTH AND FICTION SURROUNDING IT
29 Dec. 1965 15 p Transl. into ENGLISH from Tekhn.-Molodezhi (Moscow), no 11, Nov. 1965 p 26-28
(JPRS-33531; TT-65-34105) CFSTI: $1.00

The replies of six scientists to a request in a Russian periodical for more information on hypnopedia are presented. The answers give evidence of the intensive research on the subject. The fundamental possibility of man's capability to learn during sleep is accepted, although such contradictory views as the necessity for, and the omission of, hypnosis during hypnopedic sessions are held. Details are given on experiments carried out during natural sleep, under hypnosis, and in the awake state, and on electroencephalographic methods for recording and comparing biocurrent characteristics of the brain when signals are being transmitted to a sleeping person. The need for methodology and regulation of the instruction process is also stressed in conjunction with the problem of removing the fatigue which can occur during hypnopedic sessions. M.G.J.

N66-14764*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
AN OPEN CYCLE LIFE SUPPORT SYSTEM FOR MANNED INTERPLANETARY SPACEFLIGHT
J. Reece Roth Washington, NASA, 1965 23 p refs For Presentation at the AIAA and Am. Astronautical Soc. Stepping Stones to Mars Meeting, Baltimore, 28-30 Mar. 1966
(NASA-TM-X-52140) CFSTI: HC $1.00/MF $0.50 CSCL 06K

This paper proposes a solution to the problem of supporting human life during manned interplanetary space missions, in which the life support system is integrated with the propulsion system. It is proposed that the propellant of the propulsion system be stored in the form of food, and utilized by the thrustor in the form of metabolic wastes from the crew. It is shown that this life support system is compatible with anticipated manned interplanetary missions and payloads, if suitable electric propulsion systems are used. Author

N66-14790# ITT Federal Labs., Nutley, N. J.
HUMAN FACTORS RESEARCH IN 3-D DATA PRESENTATION Final Report, Sep. 1962-May 1965
Raymond C. Bassett, Morton H. Kahn, Moira La May, Joel Levy, and Donald E. Page Bedford, Mass., AFSC, Electron. Systems Div. Jun. 1965 83 p refs
(Contract AF 19(628)-274)
(ESD-TR-65-462; AD-623028) CFSTI: HC $3.00/MF $0.75

A series of experiments was performed to evaluate some of the operating characteristics and potential utility of a volumetric (i.e., real) three-dimensional display produced by projection of a CRT image onto a rotating translucent screen. Some of the variables tested were perceptibility of relative location of point targets in close proximity, perception of location of point targets relative to display boundaries and perception of absolute and relative motion of targets in the volume. Estimation of location and motion were found to be highly accurate and quite rapid. While the results do not point conclusively to specific applications, the utility of volumetric 3-d in making fine position and motion discriminations has been demonstrated. Further study would be required to ascertain utility in practical situations such as air traffic control, space surveillance, etc. Author (TAB)

N66-14793# Electronic Systems Div., Bedford, Mass. Decision Sciences Lab.
INCREMENTAL OR ONE-TRIAL LEARNING OF VERBAL SERIES
William H. Sumby Oct. 1965 26 p refs
(ESD-TR-64-555; AD-623383) CFSTI: HC $1.00/MF $0.50

The purpose of this study was to demonstrate that with judicious selection of stimulus material, evidence can be gathered to support either an incremental learning position or an all-or-none position. It is shown that if the priori response probabilities of words in a series are high, the retrieval of that series from memory will lend support to the all-or-none point of view. If, on the other hand, the a priori probabilities are low, the incremental position will be upheld. It is concluded that learning is

incremental, but that high response probability will tend to mack the supporting evidence. Author (TAB)

N66-14894# Naval School of Aviation Medicine, Pensacola, Fla.
A STUDY OF THE INTERPERSONAL VALUES REPORTED BY NAVAL AVIATION PRE-FLIGHT STUDENTS
Lawrence K. Waters 9 Jul. 1965 16 p refs
(NSAM-938; AD-622231) CFSTI: HC $1.00/MF $0.50

Changes in reported interpersonal values during pre-flight training and the relationship among surveyed, self-rated, and peer-rated values were determined. Significant changes in mean scale scores occurred after fourteen weeks of training and correlations between corresponding value scales ranged from .53 to .68. Difference in magnitude of the correlations among surveyed, self-, and peer-rated interpersonal values were found and related to variations in rater and reference frame. Author (TAB)

N66-14904*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESCRIPTION OF LANGLEY LOW-FREQUENCY NOISE FACILITY AND STUDY OF HUMAN RESPONSE TO NOISE FREQUENCIES BELOW 50 CPS
Philip M. Edge, Jr. and William H. Mayes Washington, NASA, Jan. 1966 13 p refs
(NASA-TN-D-3204) CFSTI: HC $1.00/MF $0.50 CSCL 05E

This paper describes a facility designed to provide a research capability for large-scale acoustic tests in the frequency range below 50 cycles per second. The capability exists for sinusoidal-, random-, and impulse-type environmental testing in the test chamber, 24 feet in diameter and 21 feet in length. Initial applications of the facility to extend the knowledge of man's behavior in low-frequency noise are described. These tests included whole-body exposure pressures of two orders of magnitude greater than man's previous experience in laboratory exposure at subaudible frequencies. Results obtained indicate that man can tolerate short-time exposures at spectrum levels in the range from 135 to 150 decibels; however, the subjects experienced some annoyance, discomfort, and fatigue and had a slower task performance rate. Author

N66-14923# Harvard Univ., Cambridge, Mass.
THE RELATION OF POSTTEST PERFORMANCE TO RESPONSE-CONTINGENCIES IN PROGRAMMED INSTRUCTION
Mark A. Sherman Bedford, Mass., AFSC, Electron. Systems Div., Jun. 1965 13 p refs
(Contract AF 19(628)-2404)
(ESD-TR-65-357; AD-623916) CFSTI: HC $1.00/MF $0.50

Two programs, containing fictitious subject matter, were employed in a study designed to compare the teaching effectiveness (as measured by posttest) of textual material presented (1) as contingencies for responses in a program, or (2) as material upon which responses were not contingent. The content of the programs was identical, and they differed only in that material whose reading was necessary for correct responding in one program was not necessary for correct responding in the other and vice versa. The posttest was the same for all subjects. Half of the posttest related in material which was response-contingent in one of the programs, and the other half related to material which was response-contingent in the other program. Results indicate that response-contingent material leads to higher posttest scores than the same material when it is not necessary for correct responding within the program. The probability of information being acquired from a program is increased when this information is response-contingent. Author (TAB)

N66-15008 Joint Publications Research Service, Washington, D. C.
MEMORY CAPACITY AND THE AMOUNT OF INFORMATION
P. B. Nevel'skiy *In its* Cybernetic Appl. in Psychological and Med. Probl. 13 Oct. 1965 p 14-31 refs (See N66-15004 05-04) CFSTI: $3.00

Numerous experiments confirm that decreasing the amount of new information to be learned increases memory capacity. The dependence of memory capacity on amount of information is further evidenced by the fact that recognition is more productive than reproduction; and memorization of words is more productive than that of meaningless symbols, which in effect carry more information. Further, it is pointed out that poetry is memorized more easily than prose because the former involves a limited selection of words. Memory capacity is considered as a concept and as a function of the number of symbols memorized. Experiments reviewed deal with abstract concepts, three-digit numbers, and words; and an information theory approach to memory is used in interpreting the findings. M.W.R.

N66-15008 Joint Publications Research Service, Washington, D. C.
STATISTICAL METHODS OF EVALUATING THE EFFECTIVENESS OF A HUMAN OPERATOR'S TRANSFER FUNCTION
G. A. Sergeyev and A. F. Romanenko *In its* Cybernetic Appl. in Psychological and Med. Probl. 13 Oct. 1965 p 39-52 refs (See N66-15004 05-04) CFSTI: $3.00

Variations in productivity of human operators are considered too great for use in average productivity estimates based on the assumption of the steady-state nature of input errors. The human operator is shown to master the stochastic structure of input errors. Calculation of possible relative limits of productivity variation, determined with the aid of the information transfer function, is considered to reflect the self-adjustment function of the human servo system under the action of input signals of the transient type. A statistical approach is used to investigate the errors made by human operators; and in one series of experiments with a homogeneous group of operators, considerable variation is found in the frequency structure of individual errors. Correlation functions are determined in both the frequency and time domains. M.W.R.

N66-15041# Joint Publications Research Service, Washington, D. C.
TECHNOLOGY AND THE BRAIN
G. L. Smolyan 29 Dec. 1965 23 p refs Transl. into ENGLISH from Vopr. Filosofii (Moscow), v. 19, no. 5, 1965 p 83-94 (JPRS-33516; TT-65-34090) CFSTI: $1.00

A brief review of cybernetic processes in relation to biological research is given and the analogy between complex organizations and functions of technical systems and the living organism is outlined. The term "bionics" was applied to principles of living systems that may be utilized in technology, especially the brain structure. A concept of a ramified neuron network was developed as a logical attempt to simulate complex neuron structures with varied functions of the individual neurons and their aggregations. This neuron network transmits signals multidirectionally; the exchange of information occurs simultaneously between many neutron circuits. A neuron circuit model that roughly corresponds to a probability prediction process was described. G.G.

N66-15054# Defence Research Medical Labs., Toronto (Ontario).
ANNUAL REPORT, 1963
[1963] 44 p refs
(AD-453143)

The demands made of military personnel to fly at higher heights, dive to deeper depths, move at greater speeds, penetrate and endure more hostile environments, remain vigilant under more monotonous circumstances, and detect the presence of more mobile and elusive opponents require intimate knowledge of the nature and limitations of human physical stamina and the capabilities and characteristics of human perceptual processes. As a scientific ally of the Canadian Armed Forces, the Defense Research Medical Laboratories is dedicated to adding to such knowledge and assisting in the application of it in the design of military equipment and the formulation of the most effective operational and training procedures. Author (TAB)

N66-15182# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
SELF-CONFRONTATION FOR COMPLEX SKILL TRAINING. REVIEW AND ANALYSIS Final Report, Apr.–Dec. 1964
Herbert T. Eachus Sep. 1965 22 p refs
(AMRL-TR-65-118; AD-624062) CFSTI: HC $1.00/MF $0.50

A review of the literature on self-confrontation and related phenomena was conducted to investigate the feasibility of their use as training techniques. The phenomenon of self-confrontation is the feedback of an individual's performance in a given situation through the use of videotape or sound motion picture film. This technique provides complete feedback of information and generates a situation in which subjects are quite amenable to modifications of their behavior, both verbal and nonverbal, with respect to given standards. The body of technical literature dealing with self-confrontation is small but complete enough to provide a basis for discussion of the phenomenon as a training technique. The analysis of the literature resulted in the recommendation for a research program to explore self-confrontation as a training technique for complex human skills. Author (TAB)

N66-15184# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
A REVIEW OF THE EFFECTS OF HIGH AMBIENT TEMPERATURE ON MENTAL PERFORMANCE
John F. Wing Sep. 1965 44 p refs
(AMRL-TR-65-102; AD-624144) CFSTI: HC $2.00/MF $0.50

Fifteen experiments done in various laboratories have assessed the effects of high thermal stress on mental performance. These experiments represent different combinations of exposure time and effective temperature. These studies were reviewed, and the upper thermal limit for unimpaired mental performance was found to vary systematically with exposure duration. Specifically, the lowest test temperatures yielding statistically reliable decrements in mental performance decline exponentially as exposure durations are increased up to 4 hours. When this temperature duration curve for mental performance is compared with physiological tolerance curves, it is found to lie well below them at every point in time.
Author (TAB)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N66-14339# Bell and Howell Research Center, Pasadena, Calif.
ANALYTICAL TECHNIQUES FOR THE DETERMINATION OF TRACE IMPURITIES IN CADMIUM SULFIDE Technical Documentary Report, 1 Jun. 1962–31 May 1965
R. K. Willardson and A. J. Socha Wright-Patterson AFB, Ohio, ARL Jun. 1965 69 p refs
(Contract AF 33(657)-8976)
(ARL-65-130; AD-623165) CFSTI: HC $3.00/MF $0.75

Analytical techniques were developed for the analysis of trace impurities in cadmium sulfide. The detection limit for most impurities is less than 10 parts per billion (atomic). Materials analyzed were in the form of fine powders, fragile needles and platelets, as well as bulk crystals of CdS, CdSe, ZnS, ZnSe, CdS:CdSe, CdS:ZnSe, Cd and Zn. The approaches used for obtaining accurate analytical results are applicable to most solid state materials. Author (TAB)

N66-14362# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.
THE DETERMINATION OF NITROGEN IN PLUTONIUM NITRIDE
G. W. C. Milner, I. G. Jones, and G. Phillips Aug. 1965 8 p refs
(AERE-R-5002) BIS: $0.20; HMSO: 1s 2d

Both the Dumas and Kjeldahl methods, developed for the analysis of uranium nitrides, were applied to the analysis of plutonium mononitride for nitrogen content. After slight modifications to the procedures, good agreement was obtained between the two methods on a typical PuN sample. The coefficient of variation for the Kjeldahl method was 0.8%, compared with a value of 1.0% for the Dumas method. Author (NSA)

N66-14368# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY NO. 248
Meng-Chun Ts'ao et al 30 Nov. 1965 53 p refs Transl. into ENGLISH from Hua-Hsueh T'ung-Pao (Peiping), no. 9, 14 Sep. 1965 p 38–56
(JPRS-33087; TT-65-33664) CFSTI: $3.00

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3. EXTRACTION-COLORIMETRIC DETERMINATION OF MICRO-AMOUNTS OF MOLYBDENUM WITH CRYSTAL VIOLET Ching-nan Kuo and Jen-mei Chin p 33–43 refs
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N66-14374# Commissariat a l'Energie Atomique, Saclay (France). Departement des Radioéléments.
Cs^{137} DECONTAMINATION OF CONCENTRATED FISSION PRODUCT SOLUTIONS [DECONTAMINATION EN Cs^{137} DES SOLUTIONS CONCENTREES DE PRODUITS DE FISSION]
Ch. Aubertin, I. Lefevre, and A. Raggenbass Brussels, EURATOM, 1965 55 p refs In FRENCH; ENGLISH summary
(Contract EURATOM-025-62-10 RISF)
(EUR-2535.f) CFSTI: HC $3.00/MF $0.50

In order to obtain a Cs^{137} decontaminated factor of at least 10^4 for concentrated fission product solutions, two separation techniques are examined in detail: (1) Phosphotungstate precipitation by addition of phosphotungstic acid, and (2) Cs fixation by exchange on a preformed insoluble ammonium phosphotungstate. For the conditions studied, the most promising solution is double precipitation by phosphotungstic acid using as carrier the ammonium already present in the concentrated fission product solutions. Author

N66-14380*# National Aeronautics and Space Administration, Washington, D. C.
X-RAY FLUORESCENCE ANALYSIS WITH A FOCUSED PRIMARY BEAM
J. Despujols, H. Roulet, and G. Senemaud Dec. 1965 8 p refs Presented at the 2d Intern. Symp. on X-Ray Optics and X-Ray Microanalysis, Stanford, Calif., 1963 Transl. into ENGLISH from French
(NASA-TT-F-9813) CFSTI: HC $1.00/MF $0.50 CSCL 07D

The sample to be analyzed is irradiated by a convergent, almost monochromatic X-ray beam (conventional or point-focusing type). In the first method, utilizing an intense line, an X-ray spectrometer is used for recording the X-ray spectra in the usual way. In the second and most promising method, the wavelength of the incident beam is either slightly shorter or slightly longer than the absorption-edge wavelength of the sought element. In the former case, the radiation coming into the counter includes fluorescence radiation; in the latter it does not, and the balance gives, without a spectrometer, the intensity of the fluorescence radiation due to the selected element. This method, which permits analysis of surfaces smaller than a few tenths of a square millimeter, has been applied with success. Some examples of its application (analysis of zinc in ores, determination of the thickness of very thin films of nickel) are given. Author

N66-14381*# National Aeronautics and Space Administration, Washington, D. C.
NEW METHOD OF INVESTIGATING THE CHEMICAL COMPOSITION OF A MICROVOLUME OF AN ALLOY [NOVYY METOD ISSLEDOVANIYYA KHIMI CHESKOGO SOSTAVAA V MIKROOBYEME SPLAVA]
I. B. Borovskiy and N. P. Il'in Dec. 1965 6 p refs Transl. into ENGLISH from Dokl. Akad., Nauk SSSR, Tekh. Fiz. (Moscow), v. 106, no. 4, 1956 p 655–657
(NASA-TT-F-9814) CFSTI: HC $1.00/MF $0.50 CSCL 07B

The authors describe their equipment and method of analyzing the chemical composition of a microvolume of an alloy section from the characteristic X-ray radiation. Author

N66-14401# Nuclide Corp., State College, Pa.
SOME ASPECTS OF ACHONDRITE CHEMISTRY
Werner G. Deuser 15 Sep. 1965 13 p refs
(TR-65-13)

The atomic proportions of total iron, magnesium and aluminum of all available superior analyses of achondrites were plotted on a ternary variation diagram. The four main achondrite groups, eucrites, howardites, diogenites, and aubrites, are readily distinguished without knowledge of the oxidation states of iron. Aluminum closely follows calcium in almost all cases. The extensive fractionation of an aubrite magma, as suggested by Moore, cannot be substantiated but the achondrite Shallowater may represent a link between the diogenites and the aubrites. Author

N66-14422# Defence Research Board, Ottawa (Ontario). Directorate of Scientific Information Services.
SYNTHESIS AND POLYMERIZATION OF GLYCIDYL-VINYL ETHERS
Wasaburo Kawasi and Shigeru Tsutsumi Sep. 1965 10 p refs Transl. into ENGLISH from Nippon Kagaku Zasshi (Tokyo), v. 80, no. 1, 1959 p 88–91
(T-90-J; AD-472851)

A new monomer, glycidyl vinyl ether, has been synthesized from epichlorhydrin and ethylene chlorhydrin. This monomer is easily polymerized with BF_3OEt_2, but the high polymers are not soluble in ordinary solvents of polyvinyl ether and they copolymerize with styrene. The reaction velocity equation $Rp = k\,(M)\,(c)^{0.54}$ (10C) was obtained for the polymerization of glycidyl vinyl ether in Et_2O. Since glycidyl ethyl ether gives only low polymers with BF_3OEt_2, it was concluded that the polymerization of this monomer is mainly due to the vinyl group. Author (TAB)

N66-14439# Air Force Cambridge Research Labs., Bedford, Mass. Solid State Sciences Lab.
EXPERIMENTAL STUDY OF ZONE REFINING OF THE BINARY SYSTEM TRIPHENYL ANTIMONY: BENZOIC ACID
Marvin S. Brooks and Willard R. Hancock (Philco Corp., Lexington, Mass.) Oct. 1965 85 p refs *Its* Phys. Sci. Res. Paper No. 148
(AFCRL-65-712; AD-623649) CFSTI: HC $3.00/MF $0.75

An experimental study on the zone refining of the binary system triphenyl antimony–benzoic acid is described. The isotope Sb^{124}, which is a strong gamma emitter, was employed as a tracer; this allowed a rapid in situ nondestructive analysis, closely spaced experimental points, and the opportunity to study distribution as a function of varying experimental conditions. With the aid of computers (IBM 7090 and IBM 7044) apparent k's were calculated and the experimental data compared with those predicted from various mathematical models. Author (TAB)

N66-14441# Mellon Inst., Pittsburgh, Pa.
FAR INFRARED TORSIONAL AND BENDING VIBRATIONS OF BENZALDEHYDES, PYRIDINE CARBOXALDENYDES, ACETOPHENONE, STYRENE AND THEIR HALOGEN DERIVATIVES. THE CALCULATION OF BARRIER HEIGHT TO INTERNAL ROTATION Technical Documentary Report, Jun. 1964–Jun. 1965
William G. Fateley, Foil A. Miller, and Robert E. Witkowski Wright-Patterson AFB, Ohio. AF Mater. Lab., Aug. 1965 65 p refs
(Contract AF 33(657)-11142)
(ML-TDR-64-158, Pt. II; AD-622521) CFSTI: HC $3.00/MF $0.75

The far infrared spectra of benzaldehyde, pyridine carboxaldehydes, acetophenone, styrene, nitrobenzene, and some of the halogen derivatives have been investigated. Torsional vibrations have been assigned and barriers to internal rotation have been calculated for the C-C single bond. Results are given on the shift in frequency resulting from changes from liquid to vapor phase as well as reporting the differences in the calculated barrier height. Experimental evaluation of the interferometer's performance is reported. The computed program for taking the Fourier transpose of the interferogram is given. The transmission of many available commercial crystals and polyethylenes are also reported. Author (TAB)

N66-14442# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Physics.
THE IONIZATION OF METHANE AND METHYL HALIDES USING ELECTRON AND ION IMPACT Scientific Report No. 3
H. Sjögren 10 Sep. 1965 30 p refs
(Contract AF 61(052)-762)
(AFCRL-65-776; AD-623664) CFSTI: HC $2.00/MF $0.50

The ionization efficiency curve for CH_4 was measured using the RPD technique. No break corresponding to the ionization of a (sal) electron is observed. Determination of the mass spectrum using charge exchange at different pressures indicates that the earlier value of the ionization potential, 19.4 eV, is probably due to ion-molecule reactions in the ion source. A tentative value of 24 eV is proposed in better agreement with theory. The breakdown graph of CH_3Cl was determined by use of charge exchange. Pressure dependence studies of the CH_3Cl and CH_3I mass spectra, obtained in the same way, indicate that earlier determinations of the ionization potentials of the (sal) electrons of these molecules might also be due to ion-molecule reactions in the ion source. Author (TAB)

N66-14471# Boeing Scientific Research Labs., Seattle, Wash. Geo-Astrophysics Lab.
ELECTRON RETARDING POTENTIAL STUDIES OF PHOTOIONIZATION
P. H. Doolittle and R. I. Schoen Sep. 1965 28 p refs Presented at the ASTM Meeting on Mass Spectry. and Allied Topics, St. Louis, 16–21 May 1965
(DI-82-0463; AD-623169) CFSTI: HC $2.00/MF $0.50

The use of the electron retarding potential technique in studies of ionization thresholds and relative transition probabilities to various electronic and vibrational states of ions is discussed. The gases argon, nitric oxide and hydrogen are used to illustrate the technique. The assignment of one electronic state in NO^+ is shown to be questionable and the role that autoionization may play in vibrational excitation is exhibited. Author (TAB)

N66-14473# Pennsylvania Univ., Philadelphia. Electrochemistry Lab.
ELECTROCHEMISTRY. PART I: KINETIC AND THERMODYNAMIC ASPECTS OF THE ELECTROSORPTION OF BENZENE AT PLATINUM ELECTRODES. PART II: HYDROCARBON OXIDATION STUDIES Interim Technical Progress Report, 7 Nov. 1964–6 Sep. 1965
E. Gileadi, W. Heiland, and G. Stoner Oct. 1965 130 p refs
(Contract DA-44-009-AMC-469(T))
(AD-623550) CFSTI: HC $4.00/MF $1.00

Contents: Kinetic and thermodynamic aspects of the electrosorption of benzene at platinum electrodes; Hydrocarbon oxidation studies (The electrochemical oxidation of ethylene—comparison of results by the potential sweep and steady state methods; Study of hydrocarbon oxidation in phosphoric acid at high temperature); Electrosorption of uncharged molecules on solid electrodes (a review). TAB

N66-14482*# National Bureau of Standards, Washington, D. C.
ELECTROCHEMICAL DATA, PART I Quarterly Report from NBS to NASA, Oct. 1–Dec. 31, 1965
Walter J. Hamer [1965] 32 p
(NASA Order R-09-022-029)
(NASA-CR-62024) CFSTI: HC $2.00/MF $0.50 CSCL 07D

Values to be used in a critical evaluation and tabulation of electrochemical data are defined. These include the fundamental constants, physical constants, conversion factors for electrical units, and standard conventions. The factors considered in the evaluation are summarized as the change (1) in the temperature scale from 273.16° K to 273.15° K for the ice point, (2) from international to absolute electrical units, (3) in the Faraday constant, and (4) in the scale of atomic weights. Also given are the formulas used to determine the standard of electromotive force; the Nernst factor; and chemical potentials, activities, and activity coefficients. Theoretical expressions for activity coefficients in dilute solutions, electrolytic conductivity standards, and theoretical expressions for equivalent conductances are included. Tabulated data are presented on the emf values of a cadmium sulfate cell; the Nernst factor values; emf studies of molten electrolytes; values for valence types of electrolytes; physical properties of water; activity coefficients of various aqueous solutions; minimum ion parameters; and specific and equivalent conductances. M.G.J.

N66-14489# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY NO. 239
Ch'ing-sun Yang et al 17 Nov. 1965 45 p refs Transl. into ENGLISH from Hua-Hsueh T'ung-Pao, (Peking), no. 6, 14 Jun. 1965 p 10–16, 34–44
(JPRS-32894; TT-65-33472) CFSTI: $2.00

CONTENTS:

1. THE SYNTHESIS OF α,α'-BIS-ISOPROPYLBENZENE PEROXIDE AND ITS USES Ch'ing-sun Yang p 1–20 refs

2. CYCLIZATION OF β-CYANOETHYL COMPOUNDS Hua-min Huang p 21–43 refs

N66-14504# New York Univ., N. Y. Dept. of Chemistry.
TWO REMARKS ON THE RESISTIVE CONTRIBUTION TO OVERPOTENTIAL Technical Progress Report
Benson R. Sundheim 15 Oct. 1965 15 p
(Contract Nonr-28537)
(AD-623026) CFSTI: HC $1.00/MF $0.50

The placement of reference electrodes to minimize the contribution of the iR drop to the apparent overpotential of the electrode being studied is discussed. The resistive contribution to the overpotential is determined. TAB

N66-14542# Carborundum Co., Niagara Falls, N. Y. Research and Development Div.
INTERSTITIAL COMPOUNDS OF BORON AND TRANSITION METALS Final Report
V. I. Matkovich, J. Economy, and R. F. Giese Oct. 1965 15 p refs
(Contract Nonr-4075(00))
(AD-623263)

It has been demonstrated that all of the higher borides can be classified in terms of three simple packing models based on B_{84} or B_{12} polyhedral units. The lower borides have also been classified in a similar manner. Among lower borides the structural units are either M_2B_2 metalboron mixed tetrahedra or all metal tetrahedra. Classification of all lower borides has not been completed and is limited in this report to Fe_2B, V_3B_2 and YB_4 structural types. The phases existing in the Al–B–C system have been investigated resulting in two new structural assignments and discovery of a new phase. The discrepancies reported in the alpha boron derivatives have been clarified by studies which demonstrate the existence of multiple stoichiometries within the same structural framework. Various high temperature reactions and, in particular, topotactical transitions in higher borides have been characterized by X-ray diffraction methods. Detailed structure analyses were carried out on C_4AlB_{24}, YB_{12} and YB_4. Author (TAB)

N66-14800*# American Univ., Washington, D. C.
INVESTIGATION OF ELECTROCHEMISTRY OF HIGH ENERGY COMPOUNDS IN ORGANIC ELECTROLYTES, MAY 1–OCTOBER 31, 1965
R. T. Foley, L. E. Helgen, and L. Schubert [1965] 41 p refs
(Grant NGR-09-003-005)
(NASA-CR-62023) CFSTI: HC $2.00/MF $0.50 CSCL 07D

The investigation of high energy compounds in organic electrolytes has been directed toward a clarification of the electrochemical and chemical properties of the cyclic esters, γ-butyrolactone, γ-valerolactone and propylene carbonate. The voltage range of electrolysis has been measured. These values mainly from lithium perchlorate solutions are, for γ-butyrolactone, 5.78 v., for propylene carbonate, 5.25 v., and for γ-valerolactone, 6.82 v. Potentials have been assigned to ClO_4^-, PF_6^-, Cl^-, BF_4^-, Li^+, K^+, Na^+, and other ions as indicative of their participation in electrode processes. The reaction of butyrolactone and propylene carbonate with Li, Na, K, Ca, and Mg has been studied at 100° C in a dry N_2 atmosphere. Na, K, and Ca are quite reactive and the reaction products are being studied by infrared, gas chromatographic and chemical techniques. Author

N66-14801# Library of Congress, Washington, D. C. Aerospace Technology Div.
PHOTOIONIZATION OF GASES Surveys of Soviet Scientific and Technical Literature
Charles Shishkevish 6 Dec. 1965 74 p refs
(ATD-65-91)

Presented is the second in a series of reports dealing with photoionization in gases and covering material published during the period from January 1963 through April 1965. The first part of the translation is devoted to experimental research on the coefficients of absorption from the ground states of atoms and molecules. The coefficients of absorption of helium, krypton, xenon, ethyl alcohol, argon, methane, and dimethoxymethane in the spectral range between 23.6 and 250 Å were determined. The absorption cross section of air in the vacuum ultraviolet and the fine structure of the $L_{2,3}$ absorption edge of argon are included. The second part of the report covers three papers on experimental research on photoionization and photodissociation of vapors of organic compounds. The third section deals with photoionization of positive ions and photoionization from the excited states of atoms. The final part of the report includes the only two papers on photodetachment found in the Soviet literature. The approximate photodetachment cross section of Li^- was calculated using a value of 0.81 eV for the electron affinity. Also, the photodetachment cross sections for C^-, N^-, O^-, and F^- ions were calculated in the dipole length approximation. E.E.B.

N66-14823# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.
A COMPARISON OF PROCEDURES FOR DISSOLVING IGNITED PLUTONIUM OXIDES FOR ANALYSIS
R. M. Black and J. L. Drummond 4 Oct. 1965 17 p refs
(TRG-1172(D)) HMSO: 2s

A comparison of all available methods for dissolving ignited plutonium dioxide, on an analytical scale, has shown that the rate of solution in a hydrobromic/0.15M hydrofluoric acid mixture was about six times as fast as in nitric/hydrofluoric acid; plutonium/uranium oxides did not dissolve readily in the bromide mixture. An improved apparatus made from a transparent inert plastic was used for refluxing mixed oxides with nitric/hydrofluoric acid. Plutonium oxide previously sintered at 1600° C in air was most rapidly attacked by fusion with sodium bisulphate under reflux at 800° C. Author

N66-14824# Royal Aircraft Establishment, Farnborough (England).
POLYDISPERSITY AND THE STRUCTURE OF THE POLYDIPHENYLMETHYLENE CHAIN [POLIDISPERSNOST' I STRUKTURA TSEPI POLIDIFENILMETILENA]
D. G. Val'kovskii, S. L. Sosin, V. V. Korshak, and S. A. Pavlova Aug. 1965 15 p refs Transl. into ENGLISH from Vysokomol. Soedineniya (USSR), v. 6, no. 10, 1964 p 1848–1852
(RAE-LIB-TRANS-1124) CFSTI: HC $1.00/MF $0.50

The fractional composition of polidiphenylmethylene has been elucidated and the dependence of the intrinsic viscosity on the molecular weight of the fractionated polydiphenylmethylene has been investigated. It has been shown that the polymer possesses considerable polydispersity and chain branching, which is manifested in the absence of high elastic deformation and in its amorphous structure. Author

N66-14825# Lockheed Missiles and Space Co., Sunnyvale, Calif.
BASIC STUDIES OF GAS-SOLID INTERACTIONS. III: CONSIDERATIONS IN ATMOSPHERIC CONTAMINANT REMOVAL
Andrew J. Robell, E. Vernon Ballou, and Frank G. Borgardt 30 Apr. 1965 58 p refs
(LMSC-6-75-65-22)

Three main methods of space-cabin atmospheric contaminant removal are contemplated for presently planned space missions: adsorption on charcoal; removal on basic and acidic solids; and catalytic oxidation. Theoretical and experimental contributions in these areas are discussed. The classical adsorption potential theory was found to provide a sound theoretical basis for the prediction and correlation of contaminant adsorption on charcoal. From the potential theory calculations, it was found that certain poorly adsorbed contaminants would have to be removed by an alternate method. Accordingly an experimental study was made of ammonia removal capacity of acid-impregnated charcoal and removal of acidic contaminants on a lithium hydroxide bed. A solid oxidant was also studied as a possible removal method for carbon monoxide. A theoretical study was also made for classification of contaminants according to ease of removal by catalytic oxidation. E.E.B.

N66-14845# Bell and Howell Research Center, Pasadena, Calif.
ANALYTICAL TECHNIQUES FOR THE DETERMINATION OF TRACE IMPURITIES IN CADMIUM SULFIDE Technical Documentary Report, 1 Jun. 1962–31 May 1965
R. K. Willardson and A. J. Socha Wright-Patterson AFB, Ohio. ARL Jun. 1965 68 p refs
(Contract AF 33(657)-8976)
(ARL-65-130; AD-623165) CFSTI: HC $3.00/MF $0.75

Analytical techniques were developed for the analysis of trace impurities in cadmium sulfide. The detection limit for most impurities in less than 10 parts per billion (atomic). Materials analyzed were in the form of fine powders, fragile needles and platelets, as well as bulk crystals of CdS, CdSe, ZnS, ZnSe, CdS:CdSe, CdS:ZnSe, Cd and Zn. The approaches used for obtaining accurate analytical results are applicable to most solid state materials. Author (TAB)

N66-14847# Georgia Inst. of Tech., Atlanta.
METHYLENE DERIVATIVES AS REACTION INTERMEDIATES Final Report, 27 Jun. 1962–Jun. 1965

Jack Hine 13 Sep. 1965 17 p refs
(Grant DA-ARO(D)-31-124-G309)
(AROD-3561-1; AD-473558)

The purpose of this investigation was to learn more about reactions in which methylene and its derivatives are, or have been claimed to be, intermediates. The relative efficiencies with which various phenoxide ions capture difluoromethylene were investigated in order to learn whether the o-hydroxyphenoxide ion is particularly efficient, as it might be if it acts as a bifunctional reagent. No marked increased efficiency of capture by o-hydroxyphenoxide ions is evident from the results obtained. The reactions of methylene halides with alkali-metal alkoxides were investigated to learn what the reaction conditions are at which the mechanism of displacement of the halogens changes from S_N2 to an alpha-elimination mechansim. With all the methylene halides studied under all the reaction conditions employed, it was found that, although carbanion formation occurred, it was not an intermediate step in displacement of the halogen by an alpha-elimination mechanism but instead a rather irrelevant side reaction accompanying the displacement of halogen by an S_N2 mechanism. In other studies relating to alkoxymethylenes, particularly dialkoxymethylenes, a new synthesis for compounds of the type $(RS)_2CHOR$ has been developed, the reactions of propylene glycol with haloforms and bases have been found to give a little propylene, and trimethyl orthoformate has been found to undergo deuterium exchange with deuteromethanol in the presence of an acetate buffer. Author (TAB)

N66-14666# Bureau of Mines, Laramie, Wyo. Laramie Petroleum Research Center.
MASS SPECTRA OF ORGANIC SULFUR COMPOUNDS
Glenn L. Cook and G. U. Dinneen 1965 98 p refs
(BM-RI-6698)

Correlations between mass spectra and molecular structures of 186 organic sulfur compounds are discussed. The olefinic ions, the alkyl ions, the $C_nH_{2n+1}S^+$ ions, the m/e 61 ions, and the m/e 35 ions in the spectra of thiols are related to molecular structure. In the spectra of sulfides, the olefinic ions, the m/e 61 ions, the m/e 35 ions, the $C_nH_{2n+1}SH^+$ ions, and the $C_nH_{2n+1}SH_2^+$ ions are correlated with molecular structure. For disulfides, the correlations relate $HSSH^+$ and $RSSH^+$ ions to molecular structure. Base peaks of alkylthiophenes are correlated to their molecular structures. Some unimolecular reactions of sulfur compounds in the mass spectrometer are considered. A cyclic intermediate is suggested for the reaction which produces m/e 47, CH_3S^+, and m/e 48, CH_4S^+, ions in the spectra of sulfides. An expanded ring is suggested as a possible intermediate in the reactions of thiophenes. Heats of formation of sulfur-containing ions and their appearance potentials are presented in tabular form. Ionization potentials for sulfur-containing radicals and molecules are also given. Author

N66-14679# Cornell Univ., Ithaca, N. Y.
NON-EQUILIBRIUM EFFECTS IN THE KINETICS OF GAS PHASE REACTIONS
Neil S. Snider and John Ross (Brown Univ.) Jul. 1965 35 p refs Submitted for Publication
(Contract Nonr-3623(00); Proj. Squid)
(BRN-14-P; AD-466565)

A theoretical rate equation derived for exchange reactions in the gas phase from an assumed Boltzmann equation yields statistical rate expressions for theoretical rate coefficients which in general are functions of concentration with a ratio not equal to the equilibrium constant, K. However, the theoretical rate equation may be rearranged to yield rate coefficients defined to obey the relation $K_{F,C}/K_{R,C} = K$. The rate coefficients $K_{F,C}$ and $K_{R,C}$ are also functions of concentration except in three linear cases: (1) a reaction with one of the components present in large excess; (2) a chemical reaction proceeding unaffected by inelastic processes; (3) an isomerization reaction proceeding in a large excess of inert gas. Thus for these three cases the usual phenomenological rate equation applies. In cases 1 and 3 the rate constants are determined not by chemical reaction cross sections but also by inelastic cross sections for at least some and possibly all reactants and products. Author (TAB)

N66-14687# United Kingdom Atomic Energy Authority, Harwell (England). Research Group.
BEHAVIOR OF KRYPTON AND XENON IN URANIUM METAL. RELEASE OF KRYPTON AND XENON FROM METALLIC URANIUM
Ryukichi Nagasaki and Satoru Kawasaki May 1965 27 p refs Transl. into ENGLISH from Nippon Genshiryoku Gakkaishi (Tokyo), v. 6, no. 11, 1964 p 646–655
(AERE-TRANS-1034) CFSTI: HC $2.00/MF $0.50

Diffusion coefficients and factors which influence them are considered for krypton and xenon in irradiated uranium. When samples are heated in inert gas the apparent diffusion coefficient increases; and smaller diffusion coefficients are obtained for highly irradiated samples than for samples with less irradiation. There is a sudden increase of gas release at the transformation temperature of the samples when heating takes place in inert gas atmosphere and during thermal cycling. This may be due to the migration of gas bubbles from surface diffusion of matrix atoms. Various methods for determining diffusion coefficients are discussed along with diffusion equations. M.W.R.

N66-14692# Defence Standards Labs., Maribyrnong (Australia).
THE ANALYSIS OF MICROGRAM QUANTITIES OF COPPER IN ARTIFICIAL SEA WATER
R. A. Cummins and I. C. Woods Apr. 1965 14 p refs
(TN-76; AD-469840)

An analytical procedure has been developed for the analysis of microgram quantities of copper in artificial sea water. The method, based on atomic absorption, is rapid and accurate and may be performed on the sample as received. Author (TAB)

N66-14693# Essex Univ., Colchester (England).
A CRYSTALLOGRAPHIC STUDY OF AMINOBORANE DERIVATIVES AND RELATED COMPOUNDS Final Technical Report, 1 Oct. 1964–31 Jul. 1965
G. J. Bullen [1965] 39 p refs
(Contract DA-91-591-EUC-3542)
(FTR-2; AD-471997)

X-ray diffraction photographs of aminoborane derivatives have been taken at −95° C using a cooling system in which cold nitrogen gas, produced by boiling liquid nitrogen, is passed through a Weissenberg X-ray camera in which the specimen is mounted. On cooling to −95° C liquid specimens of (dimethylamino)-dimethylborane and (diethylamino)-diethylborane show a phase change which can be observed visually but they give an X-ray pattern of diffuse rings which is nevertheless different from the pattern given by the corresponding liquid at room temperature. It is concluded that the specimens have become glasses and a suggestion is made that this may result from polymerization of the aminoboranes at low temperature to give long-chain molecules. Crystals found at room temperature in a specimen thought to be liquid (diethylamino)-dichloroborane have been shown, from their single crystal X-ray patterns and chemical analysis, to be the dimer of (dimethylamino)-dichloroborane. A small amount of work has been done on the

collection of X-ray intensity data for 1,4-diphenyl-2,3,5,6-tetramethyl-2,3,5,6-tetraza-1,4-diborine. Author (TAB)

N66-14759*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ARGENTIC OXYSALT ELECTRODES
Harold F. Leibecki Washington, NASA, Jan. 1966 15 p refs (NASA-TN-D-3208) CFSTI: HC $1.00/MF $0.50 CSCL 07D

Silver ions with plus three oxidation states in complex silver compounds have been investigated as cathode electrodes in 45 wt.% potassium hydroxide electrolytes with zinc as the anodes. Temperature coefficient of open circuit potentials, current density as a function of cell voltage, and coulombic efficiencies of the cathode at various discharge rates were obtained for $2Ag(AgO_2)_2 \cdot AgNO_3$ and the product obtained from the stability tests of $2Ag(AgO_2)_2 \cdot AgNO_3$ in 45 percent KOH. Changes of enthalpy, free energy, and entropy for the cell reaction for these two compounds were calculated from experimental data and compared with reported values for silver oxides AgO and Ag_2O. It was found that a cell with a higher energy density is obtainable from the argentic oxysalts than the commercially available AgO cells and that reserve-type cells could be developed using these compounds. The reaction product of $2Ag(AgO_2)_2 \cdot AgNO_3$ and 45 percent KOH was found to be a complex compound containing divalent silver atoms. The electrochemical reduction of this compound proceeds without the large loss of terminal voltage that is associated with argentic oxynitrate and AgO while they are being discharged. Author

N66-14802# Washington Univ., Seattle. Dept. of Chemistry.
ELECTRON SPIN RESONANCE STUDIES OF THE ELECTRONIC STRUCTURE OF FREE RADICALS IN MOLECULAR CRYSTALS Final Report, Oct. 1, 1964–Sep. 30, 1965
Gershon Vincow [1965] 10 p refs
(Grant DA-ARO(D)-31-124-G254)
(AROD-34538; AD-622700) CFSTI: HC $1.00/MF $0.50

Research in the following areas is briefly summarized: ESR of the thioxanthone S, S-dioxide mono-negative ion (conjugation in sulfones); SCF calculations of spin-density distributions in heteroatom radicals; second moments of ESR proton hyperfine spectra; ESR of $C_6H_6(+)$ and related radicals molecular orbital degeneracy; ESR or cycloheptatrienyl. TAB

N66-14820# Ohio State Univ., Columbus. Dept. of Aeronautical and Astronautical Engineering
THE CATALYTIC DECOMPOSITION OF NITROUS OXIDE AND THE THERMAL DECOMPOSITION OF NITROGEN DIOXIDE Technical Report No. 4
E. Stokes Fishburne, Daniel M. Bergbauer, and Rudolph Edse Wright-Patterson AFB, Ohio, ARL, Aug. 1965 41 p refs
(Contract AF 33(657)-8951)
(ARL-65-169; AD-622692) CFSTI: HC $2.00/MF $0.50

The reaction between atomic oxygen and nitrous oxide has been studied at temperatures ranging from 1500K to 2100K. To determine the amount of atomic oxygen released in the thermal decomposition of nitrogen dioxide it was necessary to study this decomposition in detail. This study was conducted also at temperatures ranging from 1500K to 2000K and over a wide range of concentrations and pressures. The reaction rates obtained for the various steps in the decomposition of nitrogen dioxide are in general agreement with those obtained by other investigators. The reaction of nitrous oxide in the presence of nitrogen dioxide with argon as the diluent was studied to determine if the oxygen released in the decomposition of nitrogen dioxide would accelerate the decomposition of nitrous oxide. No noticeable acceleration was observed. Many experiments were conducted with a nitrous oxide mole fraction of 0.02 and ozone mole fractions varying between 0.005 and 0.06. In these experiments the diluent was molecular oxygen. The presence of atomic oxygen definitely produced an increase in the rate of decomposition of nitrous oxide. It is found that the reaction between atomic oxygen and nitrous oxide in pressure dependent. It is shown that the different rate constants obtained by other investigators may be reasonably explained on the basis of a pressure dependent step in the reaction mechanism. Author (TAB)

N66-14864# Stanford Research Inst., Menlo Park, Calif.
CATALYTIC AND CHEMICAL REACTION RATES OF HYDROGEN ATOMS WITH GERMANIUM
K. M. Sancier, S. R. Morrison, and H. U. D. Wiesendanger Nov. 1965 20 p refs Submitted for Publication
(Contract Nonr-3623(00); Proj. Squid)
(SRI-21-P; AD-624054) CFSTI: HC $1.00/MF $0.50

The chemical and catalytic reactions between hydrogen atoms and the semiconductor germanium are investigated in order to examine the dependence of these reactions on the bulk electronic properties of the solid. Two reactions with gaseous hydrogen atoms were explored; viz., the catalytic recombination of hydrogen atoms on the semiconductor surface and the chemical reaction in which a volatile germanium hydride is produced. The recombination coefficient for hydrogen atoms on germanium was determinad for crystals of different doping levels (both n-type and p-type). At 90C, the recombination coefficient was found to be 0.25 ± 0.06, and was essentially independent of the atom density in the gas and the doping level. The recombination coefficient could be correlated with the Debye temperature of the solid as found previously for metals. As the germanium temperature was increased from 90C to 170C, the recombination coefficient increased about 50%. The hydride formation reaction rate was found to be first-order with respect to the hydrogen atom-density in the gas with a rate constant at 25C of 1.4 ± 0.2 cm/sec, independent of doping level. It is concluded that the bulk electronic properties of germanium, and probably also of silicon, do not appreciably affect either the catalytic properties for hydrogen atom recombination or the chemical properties for volatile hydride formation. Author (TAB)

N66-14873 Naval Research Lab., Washington, D. C.
SURFACE CHEMISTRY OF FLUOROCHEMICALS
N. L. Jarvis and W. A. Zisman *In its* Rept. of NRL Progr. Sep. 1965 p 1–10 refs (See N66-14872 05-06)

Since highly fluorinated organic compounds became available, it has been possible to prepare surfaces with free surface energies much lower than had previously been possible with hydrocarbon derivatives. Because of their low surface energies, fluorinated solids have the most nonwettable and nonadhesive surfaces known. It has been proved that only the outermost molecules of the surface of a solid need be highly fluorinated in order to achieve such low surface energies. In fact the most nonwetting surfaces studied to date were those covered with adsorbed monolayers of closely packed perfluoro acids, with the perfluoromethyl ($-CF_3$) groups outermost. It has likewise been found that surface-active agents containing perfluorocarbon terminal groups will lower the surface tension of water far below the values obtainable with hydrocarbon-type wetting agents. Certain fluorinated hydrocarbon derivatives have also been synthesized that show very high surface activity in a wide variety of organic liquids, the extent of surface activity being dependent upon the organophilic-organophobic balance in the fluorine-containing amphipathic molecule. It is predicted that fluorine-containing monomers and perfluoro substituted surface-active materials will find increasing application in polymers

plastics, as additives for liquids, and as protective coatings solids. Author

N66-14883# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH MOLECULAR COMPOUNDS Selected Articles
11 Jun. 1965 19 p refs Transl. into ENGLISH from Vysokomol. Soedineniya (Moscow), v. 6, no. 4, 1964 p 691–694 and 734–736
(FTD-TT-65-301/1+2+4; AD-620972) CFSTI: HC $1.00/MF $0.50

CONTENTS:

1. CATALYTIC POLYMERIZATION OF TRIMETHYLTRIPHENYLCYCLO TRISILASANE (OR TRIMETHYLTRIPHENYLCYCLOTRISILAZANE?) K. A. Andrianov and G. V. Kotrelev p 1–6 ref (See N66-14884 05-06)

2. POLYMERS WITH CONJUGATED BONDS FROM AMMONIUM CARBONATE AND AMMONIUM BICARBONATE Ya. M. Paushkin, A. F. Lunin, and O. Yu. Omarov p 71–11 refs (See N66-14885 05-06)

N66-14884 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CATALYTIC POLYMERIZATION OF TRIMETHYLTRIPHENYLCYCLO TRISILASANE (OR TRIMETHYLTRIPHENYLCYCLOTRISILAZANE?)
K. A. Andrianov and G. V. Kotrelev *In its* High Mol. Compos. 11 Jun. 1965 p 1–6 ref (See N66-14883 05-06) CFSTI: HC $1.00/MF $0.50

The catalytic polymerization of trimethyltriphenylcyclotrisilazane in the presence of alkali has been studied and it has been shown to be accompanied by elimination of benzene and the formation of polymers of cyclic structure. The properties of the polymers depend upon the temperature and duration of the reaction. Author

N66-14885 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POLYMERS WITH CONJUGATED BONDS FROM AMMONIUM CARBONATE AND AMMONIUM BICARBONATE
Ya. M. Paushkin, A. F. Lunin, and O. Yu. Omarov *In its* High Mol. Compos. 11 Jun. 1965 p 7–11 refs (See N66-14883 05-06) CFSTI: HC $1.00/MF $0.50

The results of the synthesis and study of new nitrogen and oxygen containing polymers with conjugated double bonds have been presented. For the first time polymers have been obtained of the type of

$$\left[-\overset{\overset{NH_2}{|}}{C}=N-\right]_n \text{ and } \left[-\overset{\overset{O}{|}}{C}=NH-\right]_n$$

containing conjugated double bonds in the principal chain and the heteroatom in the side chain. Author

N66-14895# Liège Univ. (Belgium).
STUDIES ON MOLTEN SALTS
Brussels, EURATOM, 1965 83 p refs Presented at the Discussions on Molten Salts Symp., 16–17 Sep. 1964 Sponsored in part by EURATOM
(Contract EURATOM-003-61-2 TPUB)
(EUR-2466.e) CFSTI: HC $3.00/MF $0.75

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4. CHEMICAL EQUILIBRIA IN MOLTEN SALTS M. Blander p 39–57 refs (See N66-14899 05-06)

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N66-14896 Amsterdam Univ. (Netherlands). Lab. for Electrochemistry.
PROPERTIES OF IONIC LIQUIDS AND MIXTURES
J. A. A. Ketelaar and A. Dammers-de Klerk *In* Liège Univ. Studies on Molten Salts 1965 p 9–19 refs (See N66-14895 05-06)

After an introductory remark stating the differences and the similarities of ionic, and molecular liquids, the lecture presents the results obtained in the study of molten mixtures of silver and alkali nitrates. By means of a stable and reversible nitrate electrode (here described), E. M. F. data have been obtained which, combined with thermochemical data, have permitted a reliable estimation of the excess entropy for such mixtures. The excess entropy is by no means small, compared to the excess enthalpy. This conclusion holds true for fairly ideal systems and for pronouncedly nonideal ones. Author

N66-14897 College de France, Paris.
ION DIFFUSION AND MIGRATION IN MOLTEN SALTS. ATTEMPTS AT INTERPRETATION BY MEANS OF A MODEL
J. Périé, F. Lantelme, and M. Chemla *In* Liège Univ. Studies on Molten Salts 1965 p 21–30 refs (See N66-14895 05-06)

The results of three types of experiment concerning ion transfer in molten salts are described; binary systems of alkaline salts with common anion, subjected to counterflow electromigration, show the existence of a critical composition at which the migration velocities of the two cations become equal. Measurements of transport numbers in the same systems show that the curves, representing cation mobility in function of the composition or of the temperature of the mixture, generally intersect. On the other hand, variations in the diffusion coefficients of these same cations are parallel. Depending on temperature or concentration, Einstein's formula appears sometimes to be exactly confirmed; in other cases, discrepancies between experimental and theoretical values are as much as 100%. These results as a whole are interpreted by a model of ionic liquids structure involving association equilibria and competition between cations for group formation with the anions. Author

N66-14898 Max-Planck-Institut für Chemie, Mainz (W. Germany).
ION MOBILITIES IN MOLTEN SALTS
A. Klemm *In* Liège Univ. Studies on Molten Salts 1965 p 31–38 refs (See N66-14895 05-06)

Mass and electric transport properties in molten salts are discussed in the light of the most recent experimental acquisitions. The comparison between diffusion coefficient and electric conductivity by means of the Nernst-Einstein equation

shows discrepancies from the value expected for non-associated liquids. A method is outlined for the evaluation of the type and degree of association. Author

N66-14899 North American Aviation Science Center, Thousand Oaks, Calif.
CHEMICAL EQUILIBRIA IN MOLTEN SALTS
M. Blander *In* Liège Univ. Studies on Molten Salts 1965 p 39–57 refs (See N66-14895 05-06)

In this paper it is discussed how the present knowledge on the thermodynamics of molten salts may be used in order to calculate chemical equilibria. The various theories on molten salts structures are analyzed and their provisions compared with the experimental data. The discussion involves binary systems with common anion, reciprocal systems consisting of two anions and two cations, and ternary systems having one single anion. Few specific chemical reactions are finally discussed in details. Author

N66-14900 Academia Republicii Populare Romine, Bucharest (Rumania). Inst. of Physical Chemistry.
CONTRIBUTION TO THE STUDY OF MOLTEN SALTS
I. G. Murgulescu and S. Sternberg In Liège Univ. Studies on Molten Salts 1965 p 59–80 refs (See N66-14895 05-06)

A large review is given of the research on molten salts carried on at the Institute of Physical Chemistry of Bucharest. Thermodynamic quantities are derived by means of E.M.F. measurements, melting diagrams, vapor pressure and calorimetric determinations. A discussion of the results follows. The viscosity of single salts and their mixtures is also made object of investigation in order to study the mass transport in these systems and to obtain a better understanding of their constitution. Author

N66-14906*# Lockheed Missiles and Space Co., Palo Alto, Calif.
ELECTROLYTIC PREPARATION OF HIGH DIELECTRIC THIN FILMS
A. E. Hultquist and M. E. Sibert Washington, NASA, Jan. 1966 57 p refs
(Contract NASw-969)
(NASA-CR-364) CFSTI: HC $3.00/MF $0.50 CSCL 07D

Approaches toward the formation of high dielectric materials in thin film form by electrolytic techniques are considered, with emphasis on barium titanate. Some attention is devoted to zirconates, niobates, and tantalates. In addition to barium compounds, the comparable calcium, magnesium, strontium and potassium double oxides are also evaluated. The basic technique employed is anodization of the applicable refractory metal with a simultaneous deposition or occlusion of the second oxide in the anodized film. Experiments are described applying this basic technique to aqueous electrolyte systems, organic electrolytes and gas phase systems. Films produced were evaluated in terms of pertinent capacitive and resistive properties. X-ray diffraction and spectrographic analyses are also reported for films of potential interest. It was demonstrated that appreciable amounts of barium and calcium could be incorporated in the films. The dielectric films as produced yield properties equivalent or slightly improved over simple anodized films. In the case of titanates and niobates, a subsequent vacuum heat treatment coupled with an air oxidation or healing step resulted in films with an order of magnitude improvement of capacitive properties and a consequent improvement in loss and resistive properties. Author

N66-14926# Pennsylvania State Univ., University Park. Materials Research Lab.
THERMODYNAMICS AND KINETICS OF THE DEHYDROXYLATION OF HYDROUS MINERALS Final Report, Aug. 1964–Jun. 1965
G. W. Brindley and Rustum Roy Jun. 1965 117 p refs
(Contract AF 19(628)-2773)
(AFCRL-65-606; AD-621826) CFSTI: HC $4.00/MF $0.75

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1. KINETICS AND MECHANISM OF DEHYDROXYLATION OF SERPENTINE G. W. Brindley, B. N. Narahari Achar, and J. H. Sharp p 6–28 refs (See N66-14927 05-06)
2. MECHANISM AND KINETICS OF DEHYDROXYLATION OF KAOLINITE G. W. Brindley, J. H. Patterson, J. H. Sharp, and B. N. N. Achar p 29–41 refs (See N66-14928 05-06)
3. KINETIC MEASUREMENTS OF THE DEHYDROXYLATION OF BRUCITE IN VACUO J. H. Sharp and G. W. Brindley p 42–50 refs (See N66-14929 05-06)
4. WEIGHT LOSS CURVES OF HYDROUS MINERALS J. H. Sharp and B. N. Narahari Achar p 51–57 refs (See N66-14930 05-06)
5. DEHYDRATION OF DIASPORE AT H_2O PRESSURES FROM 15 to 15,000 PSI J. N. Weber p 58–65 refs (See N66-14931 05-06)
6. SIMULATION BY PRESSURE DATA OF WATER EXTRACTION SYSTEMS PROPOSED FOR THE UTILIZATION OF EXTRATERRESTRIAL RESOURCES J. N. Weber, R. Roy, and R. T. Greer p 66–69 refs (See N66-14932 05-06)
7. PROTON IRRADIATION EFFECTS ON HYDROXYL CONTENT OF INORGANIC MATERIALS R. T. Greer, R. Roy, and J. N. Weber p 70–86 refs (See N66-14933 05-06)
8. LIMITATIONS OF DYNAMIC THERMAL METHODS FOR KINETIC STUDIES OF SOLID STATE REACTIONS G. W. Brindley, J. H. Sharp, and B. N. Narahari Achar p 87–93 refs (See N66-14934 05-06)
9. NUMERICAL DATA FOR SOME COMMONLY USED SOLID STATE REACTION EQUATIONS J. H. Sharp, G. W. Brindley, and B. N. Narahari Achar p 94–104 refs (See N66-14935 05-06)

N66-14927 Pennsylvania State Univ., University Park. Materials Research Lab.
KINETICS AND MECHANISM OF DEHYDROXYLATION OF SERPENTINE
G. W. Brindley, B. N. Narahari Achar, and J. H. Sharp *In its* Thermodyn. and Kinet. of the Dehydroxylation of Hydrous Minerals Jun. 1965 p 6–28 refs (See N66-14926 05-06)
CFSTI: HC $4.00/MF $0.75

The kinetics of the dehydroxylation of serpentine have been investigated at temperatures from 550° to 700° C and water vapor pressures from 10^{-5} to 80 mm. Hg. The reaction is controlled by a diffusion process and is sensitive to changes in particle size, temperature, water vapor pressure and total gas pressure. The activation energy of the process increases from 69 kcals/mole in vacuo to 120 kcals/mole at 47 mm. Hg. of water vapor. The pressure dependence of the reaction is complicated since both the activation energy and the frequency factor are pressure dependent. The reaction rate tends to zero with increase of water vapor pressure; for the particular serpentine investigated in the range from 630° to 700° C the reaction rate becomes very small or zero for vapor pressures in the range from 80 to 100 mm. Hg. The results of the investigation indicate the conditions to be satisfied for effective production of water in a lunar water generator using crushed serpentine as the source. Author

N66-14928 Pennsylvania State Univ., University Park. Materials Research Lab.

MECHANISM AND KINETICS OF DEHYDROXYLATION OF KAOLINITE

G. W. Brindley, J. H. Patterson, J. H. Sharp, and B. N. N. Achar *In its* Thermodyn. and Kinet. of the Dehydroxylation of Hydrous Minerals Jun. 1965 p 29–41 refs (See N66-14926 05-06) CFSTI: HC $4.00/MF $0.75

Previously reported data are extended to cover the dehydroxylation kinetics of four different kaolinites, at a variety of temperatures and water vapor pressures. The reaction is shown to be diffusion controlled under all the conditions studied. For one kaolinite, activation energies are derived for vapor pressures from 10^{-5} mm Hg to 45 mm Hg. The reaction rate decreases greatly with increase of pressure. Previous disagreements as to the nature of the reaction mechanism are largely explained.

Author

N66-14929 Pennsylvania State Univ., University Park. Materials Research Lab.

KINETIC MEASUREMENTS OF THE DEHYDROXYLATION OF BRUCITE IN VACUO

J. H. Sharp and G. W. Brindley *In its* Thermodyn. and Kinet. of the Dehydroxylation of Hydrous Minerals Jun. 1965 p 42–50 refs (See N66-14926 05-06) CFSTI: HC $4.00/MF $0.75

New kinetic data are presented for the dehydroxylation of single crystals of brucite under isothermal conditions in vacuo. Various mechanisms are considered all of which lead to an activation energy of 20–23 kcals/mole, but the mechanism is not uniquely determinable from kinetic measurements alone over a partial range of reaction.

Author

N66-14930 Pennsylvania State Univ., University Park. Materials Research Lab.

WEIGHT LOSS CURVES OF HYDROUS MINERALS

J. H. Sharp and B. N. Narahari Achar *In its* Thermodyn. and Kinet. of the Dehydroxylation of Hydrous Minerals Jun. 1965 p 51–57 refs (See N66-14926 05-06) CFSTI: HC $1.00/MF $0.75

To determine the water content and temperature of water loss of possible lunar minerals, thermogravimetric analysis (TGA) was used to record weight loss as a function of time or temperature at a constant heating rate. The TGA curves were obtained from 100 to 130 mg samples heated in air at approximately 3° C/min from 200° to 1100° C on a Mettler balance capable of weighing to 0.02 mg. The minerals investigated included serpentine, chrysotile, kaolinite, muscovite, biotite, obsidian, analcite, and harmotome; the observed weight losses and temperatures corresponding to the start of dehydroxylation, rapid dehydroxylation, and complete dehydroxylation are tabulated for each. Generally, it was shown that decreasing particle size increases the rate of release of water at a particular temperature. Results indicate that serpentine and kaolinite contain about 13% by weight of water, which is lost at moderate temperatures (<800° C).

M.G.J.

N66-14931 Pennsylvania State Univ., University Park. Materials Research Lab.

DEHYDRATION OF DIASPORE AT H_2O PRESSURES FROM 15 TO 15,000 PSI

Jon N. Weber *In its* Thermodyn. and Kinet. of the Dehydroxylation of Hydrous Minerals Jun. 1965 p 58–65 refs (See N66-14926 05-06) CFSTI: HC $4.00/MF $0.75

The dehydroxylation of well-crystallized diaspore AlO(OH) was investigated by different thermal analysis (DTA) at H_2O pressures ranging from 15 to 15000 psi. The pressure–temperature (P–T) data are tabulated, and compared graphically with the diaspore ⇌ corundum + water boundary, previously determined. The P–T curve is essentially vertical at all water pressures attained; grain size, in the 80 to −325 mesh range, appears to have little effect on the P–T curve position. The dehydroxylation behavior of diaspore is shown to differ from that of kaolinite, dickite, halloysite, and serpentine, as their apparent dehydration temperature increases with increasing P_{H_2O} until the 500 to 1000 psi region is reached; above that, dehydration temperatures decrease irregularly with further increase in water pressure. The P–T curve for the dynamic dehydration of diaspore is displaced from the equilibrium curve by approximately 150° to 200° C, and falls within the stability field of corundum + water. The absence of any appreciable variation in dehydration temperature in the pressure range investigated demonstrates the sluggishness of this reaction even under water pressures as high as 15000 psi.

M.G.J.

N66-14932 Pennsylvania State Univ., University Park. Materials Research Lab.

SIMULATION BY PRESSURE DTA OF WATER EXTRACTION SYSTEMS PROPOSED FOR THE UTILIZATION OF EXTRATERRESTRIAL RESOURCES

J. N. Weber, Rustum Roy, and R. T. Greer *In its* Thermodyn. and Kinet. of the Dehydroxylation of Hydrous Minerals Jun. 1965 p 66–69 refs (See N66-14926 05-06) CFSTI: HC $4.00/MF $0.75

The pressure–temperature (P–T) curve for dynamic dehydration under differential thermal analysis (DTA) conditions was displaced to higher temperatures for a given pressure with respect to the true equilibrium curves, so that the hydrate begins to decompose at a detectable rate in the P–T stability field of the dehydration product + water. The hydrated minerals studied included serpentine, kaolinite, dickite, halloysite, and diaspore. Three types of behavior were observed: (1) rapid increase in dehydration temperature with increasing pressure up to 15000 psi; (2) appreciable dehydration temperature increase with increasing P_{H_2O} up to a pressure range of several hundred to several thousand psi, followed by a reversal in the slope and subsequent dehydration temperature decrease with further increase in pressure; and (3) little change in dehydration temperature over the 15 to 15000 psi temperature range. Values of the heats of reaction are tabulated. Data obtained from different specimens of the same mineral were found to be identical except for serpentine where the three polymorphs—chrysotile, lizardite, and antigorite—were characterized by different dehydration temperatures and heats of reactions.

M.G.J.

N66-14933 Pennsylvania State Univ., University Park. Materials Research Lab.

PROTON IRRADIATION EFFECTS ON HYDROXYL CONTENT OF INORGANIC MATERIALS

Raymond T. Greer, Rustumm Roy, and Jon N. Weber *In its* Thermodyn. and Kinet. of the Dehydroxylation of Hydrous Minerals Jun. 1965 p 70–86 refs (See N66-14926 05-06) CFSTI: HC $4.00/MF $0.75

Aspects of solar wind irradiation which might apply to the formation and use of lunar water resources are investigated. The interaction of protons with matter is discussed, and the major dissipative process is identified as one involving the interaction of the proton with electrons in the solid. The net gain of hydrogen nuclei by the solid is considered. It is pointed out that interaction of the proton flux of the solar wind with either volatiles evaporated from solid phases, or with the solid phases themselves, may (1) yield H_2O capable of migrating to lunar cold traps, or (2) involve entrapment of the proton in the solid, resulting in the formation of $(OH)^-$ groups. System parameters used in solar wind simulation are outlined, and the possible effect of proton bombardment on dehydroxylation of

irradiated and nonirradiated kaolinite samples were analyzed by standard X-ray and thermogravimetric methods. Curves indicate that both samples decompose from the metastable state at essentially the same temperature; however, irradiated samples exhibited a greater weight loss than do non-irradiated subsamples of the same material. Other experiments showed that the resistivity of rutile is significantly decreased by proton bombardment. M.G.J.

N66-14934 Pennsylvania State Univ., University Park. Materials Research Lab.
LIMITATIONS OF DYNAMIC THERMAL METHODS FOR KINETIC STUDIES OF SOLID STATE REACTIONS
G. W. Brindley, J. H. Sharp, and B. N. Narahari Achar *In its* Thermodyn. and Kinet. of the Dehydroxylation of Hydrous Minerals Jun. 1965 p 87–93 refs (See N66-14926 05-06) CFSTI: HC $4.00/MF $0.75

The difficulties in obtaining information on reaction mechanisms and kinetic parameters are reviewed, and the limitations on experimental methods and theoretical considerations are discussed. The factors influencing all kinetic investigations are listed as particle size and shape, the macroscopic size of the sample, the nature of the sample holder, the total gas pressure, partial vapor pressure, and control of the ambient atmosphere. The severe limitations of differential thermal analysis (DTA) and thermogravimetric analysis (TGA) for obtaining kinetic parameters of solid state reactions are identified. These include: (1) The fast heating rates used in DTA may cause considerable temperature gradients within the specimen, resulting in approximate data which are unsuitable for a critical study of reaction kinetics. Although TGA may provide useful data if very thin layers of the sample and a slow heating rate are used, an order of reaction equation cannot be used for interpreting the curve of diffusion controlled, solid state decomposition reactions. M.G.J.

N66-14935 Pennsylvania State Univ., University Park. Materials Research Lab.
NUMERICAL DATA FOR SOME COMMONLY USED SOLID STATE REACTION EQUATIONS
J. H. Sharp, G. W. Brindley, and B. N. Narahari Achar *In its* Thermodyn. and Kinet. of the Dehydroxylation of Hydrous Minerals Jun. 1965 p 94–104 refs (See N66-14926 05-06) CFSTI: HC $4.00/MF $0.75

Many solid state reactions can be represented by equations of the type $F(\alpha) = kt$, where α is the fraction of material reacted in time t. These equations can be expressed in the form $F(\alpha) = A(t/t_{0.5})$ where $t_{0.5}$ is the time for 50% reaction and A is a calculable constant depending on the form of $F(\alpha)$. Numerical tables are given of $F(\alpha)$ in relation to α, and to $(t/t_{0.5})$, for nine equations corresponding to reactions which are diffusion controlled, or are reaction-rate controlled, or obey first order kinetics, or follow the equations of Avrami and Erofeyev. The application of the tables to experimental data is described. Author

N66-14969*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CHEMICAL SYNTHESIS OF MONOMERIC SELF-SEALANT TYPE ESTERS Status Report
Lawrence R. Moffett, Jr. 4 Nov. 1965 29 p refs
(NASA-TM-X-53358) CFSTI: HC $2.00/MF $0.50 CSCL 07C

The purpose was to develop an efficient synthetic chemical route for the preparation of alkyl esters of α-cyanosorbic acid (1-cyano-hexadienoic acid) as intermediates in self-sealant polymerization studies. The in-house investigation of the direct and indirect esterification of α-cyanosorbic acid, employing standard and non-conventional techniques, has resulted in the development of a satisfactory procedure for the preparation of *n*-butyl-α-cyanosorbate and *n*-amyl-α-cyanosorbate in yields approaching 90 percent. Parallel studies have resulted in the preparation of *n*-butyl-α-cyanosorbate in somewhat lower yields with concomitant longer reaction periods. The synthetic procedures developed in both investigations are discussed in detail, and chemical and spectral data are presented to verify the identities of the esters formed in the various reactions. This program established that the direct esterification of α-cyanosorbic acid is quite feasible and is a much preferred route to the indirect esterification through preparation of such intermediates as the corresponding acid chlorides and sodium salts. Author

N66-14999# Joint Publications Research Service, Washington, D. C.
POLYARYLATES
U. V. Korshak and S. V. Vinogradova 6 Jan. 1966 70 p refs Transl. into ENGLISH of the book "Poliarilaty" Moscow, 1964 p 3–72
(JPRS-33612; TT-66-30056) CFSTI: $3.00

Methods of chemically synthesizing polyarylates based on aromatic dicarboxylic acids and divalent phenols are given, and the chemical and physical properties of the polyarylate compounds are presented. Synthetic methods used consisted of polycondensations of chloroanhydrides of dicarboxylic acids with dihydric phenols at high temperatures, and interfacial polyesterification methods. Data on thermal, structural, mechanical, and electrical properties of the polyarylate compounds are given, along with solubility, molecular weight, and polydispersion data. Applications of the high molecular weight, high melting point compounds are discussed. L.S.

N66-15016# Naval Research Lab., Washington, D. C.
NMR ANALYSIS OF MIXED PENTAERYTHRITOL, DIPENTAERYTHRITOL, AND 1,1,1-TRIMETHYLOLPROPANE ESTERS
W. B. Moniz and C. F. Poranski, Jr. 19 Aug. 1965 25 p refs (NRL-6307; AD-621566) CFSTI: HC $1.00/MF $0.50

Benzene solutions of mixed pentaerythritol, dipentaerythritol, and 1,1,1-trimethylolpropane esters may be quantitatively assayed by proton NMR spectroscopy with an absolute accuracy of ± 5 mole-% for each of the ester types. Higher accuracies are possible if a calibration curve is used. Average acid chain length and the approximate degree of chain branching are also obtained. The NMR method can be used for monitoring base stocks, checking blend compositions, and determining constancy of formulation of oils qualified under specification MIL-L23699. NMR analyses of a group of commercial esters and of several aircraft engine lubricant formulations were made. Results were obtained on both the Varian A-60 and HA-100 spectrometers, with comparable accuracy. The A-60 is felt to be the preferred instrument, however, because its integrals are simpler to process. Author (TAB)

N66-15018# Naval Ordnance Test Station, China Lake, Calif.
AUTOXIDATION OF 1,1-DIMETHYLHYDRAZINE
W. H. Urry, A. L. Olsen, E. M. Bens, H. W. Kruse, C. Ikoku et al (Chicago Univ.) Sep. 1965 40 p refs
(NOTS-TP-3903; NAVWEPS-8798; AD-622785) CFSTI: HC $2.00/MF $0.50

The autoxidation of 1,1-dimethylhydrazine I gives formaldehyde dimethylhydrazone II, nitrogen, and water as its major products. Minor ones are ammonia, dimethylamine, dimethylnitrosamine, diazomethane, nitrous oxide, methane, carbon

dioxide, and formaldehyde. This reaction is of first order in I and of zero order in oxygen. It is catalyzed by metals and metal salts, inhibited by added 1,3-butadiene, and accelerated by ultraviolet light. A free-radical chain mechanism is postulated as the rate-determining reaction sequency. The 1,1-dimethylhydrazyl-2-hydroperoxide so formed is presumed to give the products II, hydrazine, and hydrogen peroxide via a rapid sequency of wall reactions (established in the study of liquid-phase autoxidations of 1,1-dialkylhydrazines). Nitrogen and most minor products probably result from further wall reactions of hydrogen peroxide with I, II, and hydrazine. Autoxidations of hydrazine resemble those of hydrocarbons.

Author (TAB)

N66-15044 Joint Publications Research Service, Washington, D. C.

ELECTROCHEMICAL STUDY ON CHEMICAL RATIO OF InSb

Lin-Sheng Yao *In its* Transl. on Communist China's Sci. and Technol. 6 Dec. 1965 5 p refs Transl. into ENGLISH from K'o-Hsueh T'ung Pao (Peking), no. 9, 20 Sep. 1965 p 825–827 (See N66-15042 05-34) CFSTI: $3.00

The effects of minimum variations in solid InSb compositions on the activity of liquid in were studied by electrolysis of In-rich and Sb-rich samples with liquid In at different temperatures. One or two of the electrodes were liquid In, and the other one or two were solid InSb; measurements were made twelve hours after the electrodes were inserted into a glass container. Variations in the electromotive forces between the samples and liquid In became stabilized after eight to eleven hours. Measurements of the In activity in InSb showed almost the same values as in corresponding eutectic formations. G.G.

N66-15065*# Aeronutronic, Newport Beach, Calif.

STUDY OF BASIC BIO-ELECTROCHEMISTRY Sixth Monthly Progress Report, 1–31 Aug. 1963

R. C. Bean, Y. H. Inami, and M. H. Boyer [1963] 11 p (Contract NASw-655)

(NASA-CR-69138; MPR-63-120) CFSTI: HC $1.00/MF $0.50 CSCL 07D

A study was made to determine the possible contribution of H_2O_2 to the electrode reaction in an electrochemical cell by considering the effect of catalase on cell current. It is shown that cell current supported by an anolyte solution containing H_2O_2 decays rapidly on the addition of catalase. It is also shown that addition of 0.0005 M H_2O_2 to the D amino acid oxidase (DAO)-D-tryptophane (D-T) system in the electrochemical cell gives about 5% increase in cell current. When catalase was present, however, no change occurred on the addition of H_2O_2. It was further found that addition of catalase to the DAO-DT system caused an increase in the magnitude and stability rather than a decrease in cell current. These observations lead to the conclusion that oxidation of H_2O_2 does not contribute significantly to the electrode reaction in a bio cell based on the DAO-DT system. C.T.C.

N66-15076# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.

SPECTROPHOTOMETRIC DETERMINATION OF SILICON IN Nb-Si ALLOYS

B. E. Kautzman 2 Aug. 1965 15 p refs

(Contract W-31-109-ENG-52)

(KAPL-M-6492) CFSTI: HC $1.00/MF $0.50

A method is given for the analysis of silicon in niobium–silicon alloys, where the wt % Si is in the range 0.10 to 0.40%. The silicon is determined colorimetrically forming silicomolybdic acid by the addition of ammonium molybdate. Silicomolybdic acid then is reduced with stannous chloride to the molybdenum blue complex which is read at 745 mμ. Niobium, which normally interferes, is precipitated as sodium niobate and filtered off. Author (NSA)

N66-15078# California Univ., Berkeley. Lawrence Radiation Lab.

AMINE HYDROHALIDE EXTRACTION STUDIES

Werner Mueller Jul. 1965 27 p refs Presented at the Gordon Res. Conf. on Ion Exchange, New London, N. H., 2–6 Aug. 1965 (Contract W-7405-ENG-48)

(UCRL-16254; CONF-650817-1) CFSTI: HC $2.00/MF $0.50

The behavior of amine salt extractants is discussed in the case of a tertiary amine, trilaurylamine (TLA), bound to hydrohalic or pseudohydrohalic acids: HF, HCl, HBr, HI, and HSCN. The organic diluents include cyclohexane, carbon tetrachloride, benzene, toluene, nitrobenzene, and chloroform. Conclusions made concerning metal extraction are stated. Examples given show that the composition and stability of a metal complex after extraction by an amine salt into an organic phase depend on the properties of the system amine salt-diluent and do not only reflect the behavior of the metal ion in the aqueous phase. NSA

N66-15101# Ledoux and Co., Inc., Teaneck, N. J.

EVALUATION OF ANALYTICAL METHODS FOR THE DETERMINATION OF INTERSTITIALS IN MOLYBDENUM AND TUNGSTEN Final Report, 15 Jun. 1964–31 May 1965

Silve Kallmann, Robert Liu, and Hans Oberthin Wright-Patterson AFB, Ohio, AF Mater. Lab., Aug. 1965 48 p refs

(Contract AF 33(615)-1689)

(AFML-TR-65-194; AD-622275) CFSTI: HC $2.00/MF $0.50

Analytical methods covering the determination of interstitial elements in tungsten and molybdenum (oxygen, carbon, hydrogen and nitrogen) were evaluated. Two samples of tungsten and two samples of molybdenum were analyzed for oxygen by vacuum fusion, inert gas fusion, and neutron activation techniques. Carbon methods investigated included combustion, followed by a coulometric, conductometric, or thermoconductometric finish, and also irradiation with 25 Mev gamma rays. Hydrogen methods evaluated were based on vacuum fusion and vacuum extraction. Nitrogen results became available either as a by product of vacuum fusion techniques or were obtained by variations of the micro-Kjeldahl procedure. The evaluation indicates that in competent hands a variety of techniques is capable of providing satisfactory results for oxygen, carbon and hydrogen. No proven chemical or instrumental method is available for the determination of less than 10 ppm of nitrogen. Author (TAB)

N66-15116 Catholic Univ. of America, Washington, D. C. Dept. of Electrical Engineering.

DIELECTRIC RELAXATION IN PENTANEDIOL 1,5

Francis M. Blake *In its* Elec. Eng. Res. Rev., No. 4 Jun. 1965 p 28–35 refs (See N66-15112 05-34)

The dielectric relaxation process in pentanediol 1,5 was investigated near the freezing point with emphasis on the variation of the distribution of the relaxation times as the freezing point was approached. Dielectric data for the pentanediol 1,5 are tabulated and typical Cole-Cole diagrams are shown for temperature values of +14.9°, −2.05°, and −29.9° C. In comparing these curves, the deviation from a Debye behavior is seen to arise at the lower temperature values indicating a distribution of relaxation times. This deviation and hence the distribution of relaxation times becomes greater as the temperature decreases. The data indicate that either there exists a distribution of structural relaxation times with an average time which is very much smaller than the dielectric relaxation time, or there

is a narrow distribution of structural relaxation time with an average time close in value to the dielectric time. Mechanical data by Kono indicate that the second possibility is the case in pentanediol 1,5. R.N.A.

N66-15121# Bureau of Mines, Rolla, Mo. Rolla Metallurgy Research Center.
VAPOR DEPOSITION OF COBALT-TUNGSTEN ALLOYS
James G. Donaldson 1965 23 p refs
(BM-RI-6713)

Cobalt-tungsten binary deposits were formed in laboratory experiments by hydrogen reduction of the anhydrous mixed vapors of cobaltous chloride and tungsten hexachloride. The materials were sublimed in separately heated zones of a reaction tube and were transported in a stream of purified helium into the deposition section of the tube where the chloride gases were reduced to metal by a countercurrent flow of hydrogen. Heattreating of the near stoichiometric binary metallic deposits converted nearly all to the intermetallic compound Co_3W, however, small quantities of both cobalt and tungsten remained. Mechanical tests showed that the tensile strength of heat-treated 75 percent coabit-25 percent tungsten deposits was twice as high as that of similarly treated deposits of cobalt. Author

N66-15124# Bureau of Mines, College Park, Md. College Park Metallurgy Research Center.
COPPER EXTRACTION FROM A LOW-GRADE ORE BY FERROBACILLUS FERROOXIDIANS. EFFECT OF ENVIRONMENTAL AND NUTRITIONAL FACTORS
John Douglas Corrick and Joseph A. Sutton 1965 30 p refs
(BM-RI-6714)

The environmental and nutritional characteristics necessary for maximum copper extraction from a low-grade ore by *Ferrobacillus ferrooxidans* have been explored as have many of the limiting parameters. Criteria considered were oxygen consumption, copper extracted, soluble copper concentration, temperature, pH, particle size, nutrients, and other inorganic salt concentrations. A set of environmental and nutritional conditions were developed for *F. ferrooxidans* which supported cell reproduction and maximum microbial oxidation of a low-grade copper sulfide ore. Percolator tests conducted under these optimum conditions resulted in an 18 percent increase in the quantity of copper microbially extracted over that extracted under conditions considered to be standard. Manometric tests determined those extremes of environmental conditions and nutritional factors which were detrimental to the extraction of copper by *F. ferrooxidans*. Author

N66-15157 Joint Publications Research Service, Washington, D. C.
A NEW HIGH-TEMPERATURE POLAR FIXATOR: A STUDY OF FLUORINE ELASTOMERS
Jen-en Chang, Yu-chen Ho, and I-Hsien Sha *In its* Transl. on Communist China's Sci. and Technol., No. 274 5 Jan. 1966 p 51–57 refs (See N66-15151 05-34) CFSTI: $3.00

A fluorine elastomer is shown to have superior characteristics for use as a high temperature fixator in gas chromatography. A polymer of ethanyl meta-fluorine and propenal fluorine in 3:7 ratio, this fixator has extremely high chemical stability and can be used to separate highly corrosive substances. Results are based on comparisons between the fluorine elastomer and both a silicone elastomer and ethylene glycol ethylene dicarboxylic polyester. M.W.R.

N66-15159 Joint Publications Research Service, Washington, D. C.
A STUDY OF THREE VALENCE RARE EARTH OXIDES: BERYLLIUM OXIDE SYSTEM
Wen-Lung Han and Chuk'un Kuo *In its* Transl. on Communist China's Sci. and Technol., No. 274 5 Jan. 1966 p 64–67 refs (See N66-15151 05-34) CFSTI: $3.00

A new crystal phase is reported during equilibrium studies of a three valence rare earth-beryllium oxide system. When solid state reactions of Gd_2O_3-BeO are processed at 1400° and 1450° C, the latter 20° C lower than the common melting point, no intermediate phase results. Complete decomposition occurred when the newly-obtained phase wavy light crystal was kept at a temperature of 1460° C. This new phase appeared to be slightly below maximum stability, and there was no stability phase in Gd_2O_3-BeO binary phase. The specimens which went through the melting and rapid cooling process contained a less stable system. M.W.R.

N66-15168# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO. 273
3 Jan. 1966 43 p refs Transl. into ENGLISH from Chinese periodicals
(JPRS-33566; TT-66-30011) CFSTI: $2.00

CONTENTS:

1. CHEMICAL NICKEL PLATING J.-t. Chou p 1–9 (See N66-15169 05-06)
2. CEPHALOSPORIN P. Chang p 10–35 refs (See N66-15170 05-06)
3. PREPARATION OF BUTYRALDEHYDE FROM CROTONALDEHYDE BY HYDROGENATION OVER A NICKEL CATALYST. H. Chang, K.-k T'ang, T.-h. Ch'en, and J.-y. Wang p 36–42 refs (See N66-15171 05-06)

N66-15169 Joint Publications Research Service, Washington, D. C.
CHEMICAL NICKEL PLATING
Jung-T'ing Chou *In its* Transl. on Communist China's Sci. and Technol., No. 273 3 Jan. 1966 p 1–9 Transl. into ENGLISH from Shang-Hai Chi-Hsieh (Shanghai), No. 7, Jul. 1964 p 29–31 (See N66-15168 05-06) CFSTI: $2.00

Principle, bath solution constitutents, procedure, and equipment for chemical nickel plating are reviewed. Thickness of deposition is given for periods between 10 min and 2 hr. Heat treatment increases coating hardness at temperatures up to 450° C, but hardness decreases at higher temperatures. A discussion of factors affecting plating deals with foreign impurities, pH valve, temperature, concentrations of nickel salt and hypophosphate, and the sodium acetate which serves as a buffer. M.W.R.

N66-15170 Joint Pulbications Research Service, Washington, D. C.
CEPHALOSPORIN
Pang Chang *In its* Transl. on Communist China's Sci. and Technol., No. 273 3 Jan. 1966 p 10–35 refs Transl. into ENGLISH from Hua-Hsueh T'ung-Pao (Peiping), No. 8, Aug. 1965 p 1–12 (See N66-15168 05-06) CFSTI: $2.00

The history, structure, and chemistry of cephalosporin, referred to as a semisynthetic penicillin, are reviewed; and cepham derivatives and their synthesis are discussed. Biological function, antibacterial activity, and adverse reactions

are considered. It is pointed out that these semisynthetic penicillins are stable in the presence of acid and do not react to penicillinase. It is implied that cephalosporins are being produced commercially, although yield from Sardinian cephalosporium fermentation is low. M.W.R.

N66-15171 Joint Publications Research Service, Washington, D. C.
PREPARATION OF BUTYRALDEHYDE FROM CROTONALDEHYDE BY HYDROGENATION OVER A NICKEL CATALYST
Hua Chang, K'O-kuang T'ang, Tu-Hui Ch'en, and Ju-Yu Wang *In its* Transl. on Communist China's Sci. and Technol., No. 273 3 Jan. 1966 p 36–42 refs Transl. into ENGLISH from Hua-Hsueh T'ung-Pao (Peiping), No. 8, Aug. 1965 p 55–57 (See N66-15168 05-06) CFSTI: $2.00

Relationship between the composition and preparation of the nickel catalyst and its activity and selectivity were investigated for the hydrogenation of butyraldehyde from crotonaldehyde. When using nickel oxide-pumice as the catalyst, optimum conditions for hydrogenation were obtained when the molar ratio of hydrogen to crotonaldehyde was less than two, temperature at the catalyst layer was between 120 and 130° C, and time of contact was 28 seconds. Catalyst activity and selectivity were found to be very high when the weight ratio of nickel oxide to pumice was 1:5. Using the catalyst for 20 hours did not decrease its activity. During this time the hydrogenation percentage of the carbonyl group decreased from 10 to 5%, indicating a tendency for selectivity to increase. M.W.R.

N66-15172# Naval Research Lab., Washington, D. C.
THE ADSORPTION OF n-OCTADECYLAMINE, n-OCTADECANOIC ACID, and n-OCTADECYL ALCOHOL FROM NONAQUEOUS SOLUTION ONTO HYDRATED AND DEHYDRATED METAL OXIDE SURFACES Interim Report
W. D. Bascom 5 Oct. 1965 17 p refs
(NRL-6315; AD-624025) CFSTI: HC $1.00/MF $0.50

A study has been made of the adsorption of the normal C_{18} amine, acid, and alcohol from hydrocarbon solution onto freshly polished stainless steel, iron, nickel, chromium, and platinum surfaces as a function of substrate pretreatment. The pretreatment consisted of maintaining the polished surface for three hours in a helium or air environment at selected temperatures ranging from ambient to 320° C. Isolation of the monolayer-covered surface was accomplished by the method of retraction, and the degree of coverage was determined by measuring the contact angle. Treatment of the metal surface at temperatures from 25 to 200° C resulted in a more-or-less continuous decline in ability to adsorb a close-packed monolayer of the amine. Above 200° C, however, amine adsorption increased with increasing pretreatment temperature except on platinum. The regain in amine adsorption is believed to be connected with oxide film growth. In anhydrous solution neither the alcohol nor the acid formed a close-packed monolayer. On the other hand, it was possible to obtain a monolayer and even crystallites of octadecanoic acid when the substrate was heavily hydrated and the adsorbate solution was saturated with water. Author (TAB)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see 23 Physics, General; and 21 Navigation.

N66-14344# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PAPERS OF THE INSTITUTE OF THE TELECOMMUNICATIONS INDUSTRY, WARSAW Selected Articles
25 Jun. 1965 76 p refs Transl. into ENGLISH from Przemyslowy Inst. Telekomunikacji, Prace (Poland), v. 13, no. 41, 1963 p 9–21, 39–53
(FTD-TT-64-1370/1+2+3+4; AD-470233)

CONTENTS:

1. ON THE DETECTION OF STRONGLY FLUCTUATING PULSE SIGNALS IN THE PRESENCE OF CORRELATED NOISE (CLUTTER) J. Kroszczynski p 1–35 refs (See N66-14345 05-07)
2. THE ANGER PULSE GENERATOR J. Piotrkowski p 36–73 refs (See N66-14346 05-10)

N66-14345 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE DETECTION OF STRONGLY FLUCTUATING PULSE SIGNALS IN THE PRESENCE OF CORRELATED NOISE [CLUTTER]
J. Kroszczynski *In its* Papers of the Inst. of the Telecommunications Ind. 25 Jun. 1965 p 1–35 refs (See N66-14344 05-07)

An optimum detection algorithm was considered for the case of stochastic pulse signals and correlated noise. The characteristics of optimum linear filters were determined for an ideal receiver. It was shown that the characteristic modulus of such a filter is analogous in shape to the envelope of the maxima of the filter characteristics of a multichannel receiver system optimal for the case of coherent pulse signals. The attenuation of the correlated noise for optimum and some sub-optimum characteristics was defined, and the quality of the decisions made with the aid of the system was estimated. Author

N66-14410# Naval Research Lab., Washington, D. C.
UHF AEW RADAR OBSERVATIONS OF ELEVATED TRADEWIND DUCTS Final Report
D. F. Hemenway 10 Sep. 1965 24 p
(NRL-6322; AD-623545) CFSTI: HC $2.00/MF $0.50

Airborne uhf (435-Mc/s) propagation paths observed during the course of a 12-month study of elevated tradewind ducts (Project TRADEWINDS IV) varied from 240 to 1200 nautical miles (naut mi) as compared with less than 180 naut mi observed for the same system in a standard atmospheric propagation medium. Out of 18 flights spaced over a year, 17 (94 percent) resulted in the radar detection of elevated ducts. Ten flights (55 percent) resulted in the discovery of ducts which permitted the radar detection of targets at ranges in excess of 500 naut mi. Radar data has been obtained which shows that the elevated ducts off the southern California coast can have an extent in longitude in excess of 1200 naut mi and a latitudinal extent of greater than 1000 naut mi. Average attenuation rates as low as 4 db/100 naut mi have been observed for pathlengths of over 1000 naut mi. The existence of ducts off the California coast capable of sustaining long range radio-radar propagation was not limited to the summer months. On the basis of data obtained during the 12-month study, there is evidence that the occurrence, strength, and extent of the ducts does not change significantly with the seasons of the year. The airborne uhf radar has proved to be a useful tool for the detection and observation of elevated ducts. Through the observation of ducting radar return signals, it was possible to determine the number, relative strength, height, and the thickness of elevated ducts. Author (TAB)

N66-14445# Army Electronics Labs., Fort Monmouth, N. J.
OPTIMUM FREQUENCY STUDY FOR ARMY WEATHER RADAR AND RANGE TRACKING SYSTEM
Raymond L. Robbiani Oct. 1965 17 p ref
(ECOM-2627; AD-623643) CFSTI: HC $1.00/MF $0.50

The choice of X-band frequencies for the mobile weather radar and automatic artillery atmospheric sounding set and such considerations as size, weight, rainfall attenuations, rainfall effects on target tracking, and effective data collection periods are discussed. The mobile tactical operational concepts in using the weather radar for maximum effectiveness are included. A comparison is made of detectability and attenuation effects of rain, using various frequencies. Author (TAB)

N66-14452# RAND Corp., Santa Monica, Calif.
ACOUSTIC PHASED ARRAYS FOR THE DETECTION OF NUCLEAR BURSTS IN THE ATMOSPHERE
T. F. Burke Oct. 1965 34 p
(Contract ARPA SD-79; ARPA Order 189-61)
(RM-4722;ARPA; AD-62379) CFSTI: HC $2.00/MF $0.50

An acoustic phased array serves to improve both the signal-to-turbulent-noise ratio and the signal-to-acoustic-noise ratio. The improvement in acoustic signal-to-noise ratio is, for isotropic noise, the array gain—which is calculable and is discussed herein. The improvement in the turbulent signal-to-noise ratio cannot be calculated, in view of the unknown correlation of noise in single sensors. However, it is thought likely that this improvement will be at least as much as the acoustic improvement—especially at the higher frequencies of greatest interest for small yields. This Memorandum considers, for simple unshaded square plane arrays, the dependence of array gain upon frequency, azimuth, size of array, number of sensors in the array, and uncertainty in the local velocity of sound. It is shown that an array of 16 sensors at the lattice points of a 1/2 × 1/2 mile square offers a frequency-dependent gain which rises to nearly 10 db at 0.5 cps for any azimuth and for any sound speed in the range of 1000 to 1200 ft/sec. Such an array appears to be suitable for the detection of acoustic signals from atmospheric nuclear blasts. Author (TAB)

N66-14466# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A FOUR SIDED ARRAY OF ONE TURN HELICAL ANTENNAS AND THE EFFECTS OF GROUND PLANES
Wesley Thomas Diller and John Benny Barton (M.S. Thesis) Aug. 1965 99 p refs
(GE/EE/65-3; AD-623146) CFSTI: HC $4.00/MF $0.75

The purpose is to develop an array, of 4 one turn helices, that gives circular polarization, omnidirectional coverage, and maximum power at 18 degrees above a ground plane. Free space radiation and terminal impedance are compared for several helices and parameter changes. Radiation is measured above a conducting plane, absorbent material and wire grids. Free space radiation from the array of center lead helices has omni-directional coverage and circular polarization within 4db. The radiation from the array above a wire grid is aligned near 18 degrees, has omni-directional coverage and circular polarization within 10db. Author (TAB)

N66-14528*# Collins Radio Co., Dallas, Tex.
DESIGN ANALYSIS—UNIFIED S-BAND SYSTEM FOR APOLLO NETWORK, VOLUME 1, PARTS I AND II Engineering Report
28 Oct. 1964 353 p *its* Rept.-523-0556527-001D3M, Vol. 1
(Contract NAS5-9035)
(NASA-CR-69085) CFSTI: HC $7.00/MF $1.75 CSCL 09F

Design analyses of the physical and performance characteristics of the unified Apollo S-band subsystems are presented. These cover the antenna subsystem, cassegrain feed system, acquisition antenna, parametric amplifier, converter design, tracking receiver, signal data demodulator, antenna position encoding system, antenna position programmer, tracking data processor, timing system, servo control and drive subsystem, up-data subcarrier oscillators, power amplifier, up-data verification receiver, collimation system, and noise figure and test signal subsystem. Data include functional descriptions, specifications, reliability and error analyses, and test procedures. Schematics, block diagrams, and graphs amplify the text. M.G.J.

N66-14529*# New Mexico State Univ., University Park. Physical Science Lab.
THE DESIGN AND PERFORMANCE OF MODEL 2.041 QUADRALOOP TELEMETRY ANTENNAS FOR THE NASA JAVELIN, FLIGHT 12.03
6 May 1964 59 p refs
(Contract NAS5-3318)
(NASA-CR-69095) CFSTI: HC $3.00/MF $0.50 CSCL 09F

The electrical characteristics of the Model 2.041 Quadraloop two element arrays used on the Javelin 12.03 are presented. One array is tuned to 231.4 Mc/sec and the other array is tuned to 240.2 Mc/sec. Both arrays are used for telemetry. Impedance and radiation pattern data are presented when a Fiberglas nose cone is mounted over the antenna arrays. Author

N66-14530*# Collins Radio Co., Dallas, Tex.
DESIGN ANALYSIS—UNIFIED S-BAND SYSTEM FOR APOLLO NETWORK, VOLUME 2, PARTS III, IV, AND V Engineering Report
28 Oct. 1964 181 p refs *its* Rept.-523-0556527-001D3M, Vol. 2
(Contract NAS5-9035)
(NASA-CR-69094) CFSTI: HC $5.00/MF $1.00 CSCL 09F

A tentative basic arrangement of the operations room equipment for the 30-foot unified S-band sites is presented, as part of the design analysis of the Apollo network systems. Details are given on the mounting, installation, or placement of data and timing system racks, cabling, equipment cooling, and power amplifer motor generator, and the dimensions of the electromechanical building and heat exchanger area. Heat dissipation and power requirements are estimated, and the installation design criteria are outlined. System performance is evaluated, with consideration given to the effects due to thermal noise, composite main tracking system errors, acquisition system errors, and transmit performance. Specifications are included for the signal data demodulator, high power combiner, error code generator, and message encoder unit. Reliability analyses data are reported for the antenna position programmer, single and dual tracking data processors, timing system, and the X-Y antenna position encoding system. M.G.J.

N66-14543# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE EVALUATION OF ERROR PROBABILITIES OF DIGITAL SYSTEMS IN THE PRESENCE OF ADDITIVE BECKMANN NOISE
Robert A. Reinman (M.S. Thesis) Aug. 1965 68 p refs
(GE/EE/65-19; AD-623140) CFSTI: HC $3.00/MF $0.75

Mathematical expressions for error probabilities of coherent amplitude- and phase-shift keyed digital communication systems in the presence of additive narrowband noise are developed. A digital computer program is developed which evaluates these error probabilities if the noise envelope has

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a distribution of the form developed by Petr Beckmann in 1964. Beckmann postulated noise as the sum of overlapping impulses of energy whose envelopes are of exponential form. Typical error probabilities as a function of signal-to-noise ratio and number of levels in the system are plotted. Author (TAB)

N66-14547# Ohio State Univ. Research Foundation, Columbus. Antenna Lab.
COMPUTER OPTIMIZATION OF A CORNER REFLECTOR FOR ECHO ENHANCEMENT WITH CIRCULAR POLARIZATION
Jack H. Richmond 22 Sep. 1965 19 p refs
(Contract NOw-65-0329-d)
(Rept.-1968-2; AD-623371) CFSTI: HC $1.00/MF $0.50

When a circularly polarized wave is incident on a trihedral corner reflector, the backscattered wave is circularly polarized with the opposite sense of rotation. However, by coating one of the conducting surfaces of the reflector with dielectric layers, it is possible to obtain a circularly polarized backscatter wave having the same sense of rotation as the incident wave. With the aid of a digital computer, the thicknesses of the dielectric layers can be optimized in an efficient manner to obtain the best performance over the pertinent range of incidence angles. This report includes a computer program for this purpose and describes an optimized four-layer reactive wall. Author (TAB)

N66-14562# Lincoln Lab., Mass. Inst. of Tech., Lexington.
HAYSTACK POINTING SYSTEM: INTERCOM
Arthur A. Mathiasen and John D. Drinan, ed. 9 Sep. 1965 188 p *Its* Tech. Note-1965-39
(Contract AF 19(628)-5167)
(ESD-TDR-65-424; AD-622666) CFSTI: HC $4.00/MF $1.00

The Intercom program in the Haystack pointing system provides communications between the pointing system and an experimenter at Haystack using the console keyboard typewriter. A user of the Millstone or the West Ford site may also direct the pointing system via a teletypewriter. The structure of the program, the calling sequence for it, and the conventions affecting the operator are described. Author (TAB)

N66-14588# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRONIC PHOTOGUIDE
L. V. Kasanfomaliti 8 Oct. 1965 9 p refs Transl. into ENGLISH from Byul. Abastumani Astrofiz. Observ. (USSR), no. 30, 1964 p 137–138
(FTD-TT-65-1421/1+4; AD-622345) CFSTI: HC $1.00/MF $0.50

A system is proposed for automatic tracking by telescope, based on the dissector LI-601 television transmitter tube. TAB

N66-14629*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEMONSTRATION OF A QUANTILE SYSTEM FOR COMPRESSION OF DATA FROM DEEP SPACE PROBES
Tage O. Anderson, Isidore Eisenberger, Warren A. Lushbaugh, and Edward C. Posner 1 Dec. 1965 29 p refs
(Contract NAS7-100)
(NASA-CR-68997; JPL-TR-32-772) CFSTI: HC $2.00/MF $0.50 CSCL 09F

The theory and design of an advanced engineering prototype of a quantile system of data compression for space telemetry is described. The basic idea is to transmit a few quantiles of a histogram of experimental values formed aboard a spacecraft. Only these quantiles are transmitted to earth, and yet a large part of the information that was contained in the original histogram can be reconstructed on earth. Compression ratios on the order of 100 to 1 are obtainable at 100% efficiency with a simple device that performs no on-board arithmetic operations. After summarizing the theoretical background governing the use of quantiles, what the design considerations of such a system should be are considered. Data compression ratios are computed for a typical application of the quantile system. The detailed description of the advanced engineering quantile system that has been built is discussed; in addition, a block diagram is given and analyzed. An important feature of the quantile system is its self-adaptive features; these are studied. Examples are given whereby quantile systems for compressing telemetry data can find application in civilian technology. Finally, experimental results using the constructed system are given. Author

N66-14643# Royal Inst. of Tech., Stockholm (Sweden). Speech Transmission Lab.
[SPEECH SPECTRUM ANALYSIS TECHNIQUE] Quarterly Progress and Status Report, 1 Apr.–30 Jun. 1965
J. Liljencrants et al 15 Jul. 1965 65 p refs
(Contract DA-91-591-EUC-3413; Grants NIH NB-04003-03; AF-EOAR-65-51)
(STL-QPSR-2/1965; AD-472399)

This report discusses: (1) a filter bank speech spectrum analyzer; (2) studies of the voice source by means of inverse filtering; (3) on the coordination of articulatory and phonatory activity in the production of Swedish tonal accents; (4) analysis of labial movement; (5) electromyographic studies of labial articulations by means of needle electrodes; (6) estimating short-term context-dependence of formant pattern perception; stimulus specification; (7) the S.T.L. Ionophone Sound Source. Author (TAB)

N66-14721# Airtron, Inc., Morris Plains, N. J.
DUPLEXER FOR SIDE-LOOKING RADAR Third Quarterly Report, 1 Jan.–31 Mar. 1965
Morrell L. King, Donald A. Lepore, J. W. Nielsen, and E. Wantuch [1965] 28 p refs
(Contract DA-28-043-AMC-00280(E))
(R11-482; AD-623853) CFSTI: HC $2.00/MF $0.50

The results of the investigation of hot-pressed nickel ferrites is described along with the performance of these materials in the three-port circulator. Two sphere YIG limiter-filters have been designed and the high power performance is presented. Conventionally fired and hot-pressed ferrites are compared, as to performance in the phase shift section of a latching four-port switch. Author (TAB)

N66-14730# Air Force Cambridge Research Labs., Beford, Mass. Microwave Physics Lab.
ASYMPTOTIC SOLUTIONS OF DIPOLES IN A SEMI-INFINITE MEDIUM
Kondagunta U. Sivaprasad Sep. 1965 66 p refs *Its* Phys. Sci. Res. Papers No. 131
(AFCRL-65-661; AD-623927) CFSTI: HC $3.00/MF $0.75

A theoretical analysis is made of the electromagnetic fields in two homogeneous media separated by a plane interface with a point source located in the denser medium. The solution is expressed in the form of integrals which cannot be evaluated explicitly. Asymptotic evaluations of the integrals have been made by many investigators using the saddlepoint technique. In the present work, all known asymptotic results are presented in one comprehensive form, using a modification of the method suggested by Lighthill for the asymptotic evaluation of the Fourier integrals. The regions of validity of the solutions are indicated whereever possible. The advantage of this method over others is its ease and simplicity. The present results agree

term by term with the earlier ones of Banos and Wesley (1953–1954), and Paul (1959), who investigated the case of a source and receiver close to the interface, and an arbitrary location of source and receiver, respectively. The results obtained in the report are also compared with those of Stein (1955). Author(TAB)

N66-14804# Ohio State Univ. Research Foundation, Columbus.

ANTENNA LOBE SUPPRESSION. VOLUME II: THE E-PLANE RADIATION PATTERN OF AN ANTENNA MODEL FOR HORN ANTENNAS Final Report

J. S. Yu and R. C. Rudduck Griffiss AFB, N. Y., RADC, Oct. 1965 63 p refs

(Contract AF 30(602)-3269)

(RADC-TR-65-186, Vol. II; AD-623073) CFSTI: HC $3.00/MF $0.75

Diffraction theory is used in analyzing the radiation characteristics of typical horn antennas. The far-sidelobe radiation has been solved without employing equivalence principles which are impractical in the problem. A corner reflector with a magnetic line source located at the vertex is proposed as a model for the E-plane radiation of horn antennas. Diffraction theory is applied to formulate the radiation pattern of this antenna model. A complete pattern, including multiple interactions and images of induced line sources, is obtained in infinite series form. Diffraction mechanisms are used for appropriate approximations in the computations. Emphasis is made on the continuity of the radiation patterns. The computed patterns are in excellent agreement with measured patterns of typical horn antennas. Radiation intensity of the backlobe relative to mainlobe intensity is obtained as back-to-front ratio and plotted as a function of antenna dimensions. A set of measured back-to-front ratios is presented to demonstrate the validity of computation. Author(TAB)

N66-14805# Ohio State Univ. Research Foundation, Columbus.

ANTENNA LOBE SUPPRESSION. VOLUME III: RADIATING MECHANISMS IN A REFLECTOR ANTENNA SYSTEM Final Report

Leon Peters, Jr. and Terence E. Kilcoyne Griffiss AFB, N. Y., RADC., Oct. 1965 23 p refs

(Contract AF 30(602)-3269)

(RADC-TR-65-186, Vol. III; AD-623074) CFSTI: HC $1.00/MF $0.50

The corrugated horn represents a good feed in a reflector antenna system. It is used in this report as a feed for an offset parabolic antenna. The various radiation mechanisms are discussed and means are suggested for further reduction of undesired radiation. Author(TAB)

N66-14806# Ohio State Univ. Research Foundation, Columbus.

ANTENNA LOBE SUPPRESSION. VOLUME IV: THE H-PLANE RADIATION PATTERN OF HORN ANTENNAS Final Report

J. S. Yu and R. C. Rudduck Griffiss AFB, N. Y., RADC, Oct. 1965 54 p refs

(Contract AF 30(602)-3269)

(RADC-TR-65-186, Vol. IV; AD-623075) CFSTI: HC $2.00/MF $0.50

Diffraction theory is use to formulate the H-plane radiation pattern of a horn antenna. Excellent agreement between computed and measured patterns is achieved by considering contributions from both the principal H-plane and E-edge diffractions. The pattern is computed by superposition of various diffracted rays which are described by wedge diffraction. This technique is demonstrated to be as accurate and practical without employing aperture integration techniques. Author(TAB)

N66-14807# Ohio State Univ. Research Foundation, Columbus.

ANNTENNA LOBE SUPPRESSION. VOLUME VI: DIFFRACTION BY CONDUCTING WALLS OF FINITE THICKNESS Final Report

J. S. Yu and R. C. Rudduck Griffiss AFB, N. Y., RADC, Oct. 1965 52 p refs

(Contract AF 30(602)-3269)

(RADC-TR-65-186, Vol. VI; AD-623077) CFSTI: HC $2.00/MF $0.50

Diffraction of thick walls is computed by the superposition of wedge diffractions. A new method for computing certain wedge diffractions is derived in series form of cylindrical wave functions to overcome deficiencies in Fresnel integral form. Diffraction characteristics of certain wedges are computed by both forms as functions of wedge geometry. A new technique is employed to formulate simultaneous linear equations for solving unknown coupling coefficients among wedges of a thick wall. The coupling coefficients thus solved are used to obtain continuous radiation patterns of different configurations of a thick wall. Thick wall diffraction is applicable to reduction of backlobe radiation of aperture antennas. In this regard, the electromagnetic compatibility of a thick wall for use of typical horn antennas is discussed. Author(TAB)

N66-14813# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

BROAD BAND RADIOINTERFEROMETER

V. V. Vitkevich 17 Sep. 1965 11 p ref Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 91, no. 6, 1953 p 1301–1303

(FTD-TT-65-821/1+2+4; AD-622385) CFSTI: HC $1.00/MF $0.50

The change in radio radiation spectrum of the receiving source will lead, apparently to a change in width of interference pattern of radio reception. Consequently the broad band interferometer can be used as a measuring medium for the spectral composition of the radiating object. A broad band interferometer with several antennas may create a 'knife like' radio reception pattern. TAB

N66-14835* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

TELEMETRY AND TELEVISION

W. E. Zrubek *In* NASA, Washington NASA 1965 Summer Conf. on Lunar Exploration and Sci. 1965 p 397–406 (See N66-14826 05-07) GPO: HC $1.50; CFSTI: MF $2.25

Apollo spacecraft telemetry and television systems are considered in terms of their use in carrying out scientific experiments. A discussion of telemetry deals with pulse code modulation on the lunar command and excursion modules as well as the three subcarrier oscillators on the command module. Television and communication capabilities are mentioned along with data subsystem processes. Normal and reduced data formats are tabulated for the command module. The digital data subsystem has a normal rate of 1280 bits/sec; and a high rate of 10 240 bits/sec; the latter will require an 85 ft receiving antenna. A word length of eight bits is planned. M.W.R.

N66-14837# Wisconsin Univ., Madison. Mathematics Research Center.

ELECTROMAGNETIC WAVE PROPAGATION IN AN HOMOGENEOUS TRANSVERSELY ANISOTROPIC MEDIUM

G. S. S. Avila Jul. 1965 15 p refs
(Contract DA-11-022-ORD-2059)
(MRC-570; AD-623765) CFSTI: HC $1.00/MF $0.50

Maxwell's equations in the special case of a homogeneous, transversely anisotropic medium are considered. It is shown that two-dimensional problems can be conveniently treated in terms of a scalar potential. The field generated by sources in the absence of boundaries is examined. Author (TAB)

N66-14845# Michigan Univ., Ann Arbor. Radiation Lab.
MINIMIZATION OF END-FIRE RADAR ECHO OF A LONG THIN BODY BY IMPEDANCE LOADING
Kun-Mu Chen Oct. 1965 28 p refs Prepared for Mich. State Univ.
(Contract AF 33(615)-1656)
(TR-4; AD-623729) CFSTI: HC $1.00/MF $0.50

A theory of the minimization of the end-fire radar echo of a long, thin body by an impedance loading technique is presented. When a long, thin body is illuminated by a plane wave in the region of longitudinal incidence, a large back scatter is observed. This back scatter is due to the induced traveling wave which is reflected from the rear end of the body. By an appropriate impedance loading, this back scatter can be minimized. In this paper, the induced current on a long, thin and loaded cylinder is studied. The optimum impedance loading which minimizes the endfire radar echo is explicitly obtained. Theoretical results are compared with the experimental data and an excellent agreement is obtained. Author (TAB)

N66-14857# Sylvania Electric Products, Inc., Mountain View, Calif. Electronics Defense Labs.
THREE-AXIS FIBERGLASS PEDESTAL
Menahem Suliteanu and Frederick M. Fonda, Jr. 1 Jun. 1965 102 p refs
(Contracts DA-36-039-AMC-03404(E); DA-28-043-AMC-00379(E))
(EDL-M787; AD-624098) CFSTI: HC $3.00/MF $0.75

The objective of this project was to develop, build and test a high-performance, lightweight, three-axis pedestal using a design concept that would allow applications ranging from small, very lightweight airborne, through medium-size shipboard, to large ground-based antennas. For systems requiring only a two-axis pedestal, the design had to have the capability of eliminating the third axis motion with minimum redesign. This report includes a description of the design approach, design solution, and the details of a prototype to be built and used with a 10 foot diameter reflector. The design, fabrication and test of a full-scale, instrumented friction drive mock-up, and fabrication techniques development. A servo-control system for the friction drive was developed and tested with the full-scale mock-up. Results indicate very good performance of the friction drive. Design and experimental data indicate also that the lightweight goal will be met. Author (TAB)

N66-14861# Northeastern Univ., Boston, Mass.
ORTHOGONAL SIGNALLING PULSES WITH THE SAME AUTOCORRELATION Scientific Report No. 3
Denis W. Fermental Jun. 1965 110 p refs
(Contract AF 19(628)-3312)
(AFCRL-65-462; AD-624217) CFSTI: HC $4.00/MF $0.75

Two methods for synthesizing orthogonal code pulses with the same autocorrelation are presented. One method determines polynomials of differentiation that operate on a pulse to generate the code waveforms. It is shown that these polynomials determine the moments of the energy density spectrum of this pulse. Polynomials are presented for generating N code waveforms, and the moments of the associated energy density spectrum are determined, for any N. A method for constructing an energy density spectrum of a pulse with a specified sequence of moments is presented. A second approach for construction orthogonal pulses is explored. This method makes use of trigonometric polynomials. The constraints on these polynomials are established, and an algorithm is presented for constructing any number of orthogonal waveforms. Examples are provided to demonstrate the use of both methods. Author (TAB)

N66-14866# ITT Kellogg, Chicago, Ill.
FEASIBILITY MODEL DEVELOPMENT DROP AND INSERT EQUIPMENT FOR MULTIPLEX Final Report, May 1964–Feb. 1965
Joseph F. Doyle and Foster W. Frazee Griffiss AFB, N. Y., RADC, Oct. 1965 156 p
(Contract AF 30(602)-3429)
(RADC-TR-65-220; AD-624100) CFSTI: HC $4.00/MF $1.00

The principal aim of the work described herein was the development and construction of a practicable single channel drop and insert multiplex system having a twelve-channel selection capability in the 'B' group from 60KC to 108KC. Secondary aims were analytical verification of design feasibility as applied to 'A' group frequencies from 12KC to 60 KC and investigation of state-of-the-art miniaturization techniques in circuitry and packaging. A single-step modulation and demodulation plan was used with band stop–band pass filters operating at group channel frequencies. Identical phase and amplitude equalizers were installed in the drop circuitry and in the insert path. Out-of-band signalling facilities were included. Engineering feasibility model consisted of a relay rack mounted, externally powered, full duplex common equipment unit (voice frequency signalling circuitry) with 12 sets of plug-in band stop–band pass filter and carrier oscillator subassemblies. Final system tests indicated some improvement is desirable in pass band ripple, particularly in the higher frequency channels. Crosstalk, carrier suppression, distortion and other transmission characteristics were satisfactory. Author (TAB)

N66-14919# Michigan State Univ., East Lansing. Div. of Engineering Research.
A SLOTTED CYLINDER WITH ZERO BACK SCATTERING
Kun-Mu Chen Oct. 1965 26 p refs Prepared for Mich. Univ.
(Contract AF 33(615)-1656)
(TR-3; AD-623728) CFSTI: HC $1.00/MF $0.50

It is shown that the back scattering of a thick cylinder can be eliminated by slotting the cylinder and backing the slot with an optimum impedance. An infinite cylinder with an impedance-backed longitudinal slot is assumed to be illuminated by a plane EM wave with a transverse electric field. The induced current and the scattered fields are studied. The optimum impedance which backs the longitudinal slot to achieve zero back scattering is explicitly obtained. This optimum impedance should prove useful in the practice of radar camouflage. Author (TAB)

N66-14937# Naval Research Lab., Washington, D. C.
AN INVESTIGATION OF THE MODAL INTERFERENCE OF VERY-LOW-FREQUENCY RADIO WAVES
F. J. Rhoads and W. E. Garner 27 Oct. 1965 68 p refs
(NRL-6359; AD-623291) CFSTI: HC $3.00/MF $0.75

A very-low-frequency (vlf) radio-wave propagation experiment has been designed to study modal interference effects and the extent of agreement with theoretical results obtained previously. The experimental data are the field strengths of the vlf transmissions from the U.S. Navy transmitting stations NPM and Haiku in Hawaii and NPG near Seattle, Washington. These data were recorded aboard an aircraft while in flight between California, Guam, and Japan, and also at a field site near Washington, D. C. During the experiment, NPM transmitted for various periods on 16.6, 19.8, 22.3, 24.0, and 26.1 kc/s. The Haiku

transmissions were on 16.6 and 19.8 kc/s, while NPG was on 18.6 kc/s continuously. The experimental field-strength-versus-distance graphs show considerable modal interference and very good agreement with the theoretical results for the isotropic case. For frequencies above 20 kc/s the experimental data indicate the existence of at least the first three modes for propagation to the west and to the east, out to distances greater than 3 megameters. The data at 19.8 kc/s, however, indicate first-three-mode effects for propagation to the east but only two modes to the west. The fading of the field strengths at Washington, D. C., during sunrise was frequently greater than 20 db. The depth of the fades, in general, increased with frequency, whereas their time of occurrence was relatively independent of frequency over the range of 19.8 to 26.1 kc/s. Author (TAB)

N66-14956*# Ohio State Univ. Research Foundation, Columbus. Antenna Lab.

DETERMINATION OF RMS HEIGHT OF A ROUGH SURFACE USING RADAR WAVES

Donald E. Barrick 31 Aug. 1965 60 p refs *Its* Rept.-1388-19 (Grant NsG-213)

(NASA-CR-69207) CFSTI: HC $3.00/MF $0.50 CSCL 20N

An experiment is described which can be used to determine the mean square height of a rough surface in terms of the correlation between two backscattered waves at different frequencies as a function of frequency separation. This scheme is analyzed both for rough planar surfaces and rough spherical surfaces (e.g., planetary surfaces). Thus far, no experiment involving radar has been suggested which can measure the rms surface roughness height; only the rms surface slope can be estimated from radar measurements. The scheme is simple: a continuous radar carrier is amplitude modulated by a low frequency signal and the correlation between the two sidebands is measured as a function of the modulating frequency. In the analysis, the backscattering cross section of a large rough sphere is derived also. Author

N66-14957*# Ohio State Univ. Research Foundation, Columbus. Antenna Lab.

ARRAY SYNTHESIS—A LEAST INTEGRAL SQUARE ERROR METHOD

R. T. Compton, Jr. 20 Aug. 1965 34 p ref *Its* Rept.-1691-14 (Grant NsG-448)

(NASA-CR-69206) CFSTI: HC $2.00/MF $0.50 CSCL 09F

This report presents a method of array synthesis based on a least integral square error criterion. After certain assumptions about array symmetry, it is shown how the array coefficients may be chosen to minimize the integral square error between the antenna pattern and some "desired" pattern. The method is applicable to nonuniformly spaced arrays. Two numerical examples are given. Author

N66-14963*# Ohio State Univ. Research Foundation, Columbus. Antenna Lab.

A MORE EXACT THEORY OF BACKSCATTERING FROM STATISTICALLY ROUGH SURFACES

Donald E. Barrick 31 Aug. 1965 205 p refs *Its* Rept.-1388-18 (Grant NsG-213)

(NASA-CR-69200) CFSTI: HC $6.00/MF $1.25 CSCL 20N

Approximations are examined in an attempt to improve and extend the theory of backscattering from rough surfaces, with the aim of ascertaining a more satisfactory relationship between the statistics of the backscattered electromagnetic wave and the statistics of the rough surface. The approximations involved in the use of the Helmholtz integral for the backscattered field are critically examined. A physical optics approximation is also examined, and it was found that this approximation permits the total fields at the surface to be written in terms of the incident and scattered fields (which are related to the incident fields by reflection coefficients). The ranges of this high frequency approximation are determined. The usual far field approximations are re-evaluated and these requirements are relaxed when applied to rough surfaces. Other facts about rough surface statistics are also brought out in the mathematical analysis. L.S.

N66-14967*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

SPACE PROGRAMS SUMMARY NO. 37-36, VOLUME III FOR THE PERIOD SEPTEMBER 1, 1965 TO OCTOBER 31, 1965. THE DEEP SPACE NETWORK

30 Nov. 1965 80 p refs

(Contract NAS7-100)

(NASA-CR-69196) CFSTI: HC $3.00/MF $0.75 CSCL 17B

Engineering and research developments in communications related to space activities are reported. Discussed are system designs for a deep space network; S-band implementation for a deep space instrumentation facility; a 100-kw S-band final amplifier; a Mariner IV 100-kw CW transmitter; a dual carrier test 100-kw Klystron; a lunar and planetary radar module; and automatic checkout equipment for the Mark I ranging subsystem. In addition, work is discussed for an experimental closed cycle refrigerator for masers; for CW signal power calibration with thermal noise standards; for a simultaneous lobing radiometric tracking system; for a two-way RF carrier acquisition; for Venus station operations; for frequency generation and control; and for information systems. L.S.

N66-14995 Joint Publications Research Service, Washington, D. C.

ON CONNECTING THE MINSK-1 COMPUTER TO A TELEGRAPH CHANNEL

N. G. Zaytsev, V. A. Lebedev, and A. B. Tyakhti *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 238-247 (See N66-14976 05-10) CFSTI: $6.00

Simple devices are described for combining the Minsk-1 computer with a telegraph channel. The devices insure automation of reception and transmission of alphabetic-digital information between the computer and the user. Simplification of the diagrammatic solutions of the devices has been achieved by the use of program processing of information at its input and output. Author

N66-15110# Library of Congress, Washington, D. C. Aerospace Technology Div.

COMMUNICATIONS NETWORKS. PART I: REVIEW OF SOVIET LITERATURE Surveys of Soviet Scientific and Technical Literature

Vladimir Podpaly and Wallace Creten 10 Sep. 1965 140 p refs Compilation of abstracts *Its* Rept.-5 (ATD-P-65-71)

An annotated bibliography is presented on Soviet communications equipment and communications facilities and their location. R.N.A.

N66-15128# Airborne Instruments Lab., Inc., Mineola, N. Y.

A WAVEGUIDE GLIDE SLOPE ANTENNA Final Report

Jul. 1965 105 p

(Contract FAA/BRD-317)

(RD-65-46)

This report describes a development and flight test program of a directional glide-slope system that is fully compatible with ICAO ILS standards and conventional airborne receivers, but that does not rely upon the ground-reflected

signals required by conventional glide slope systems. The theory and application to ILS of the rugged, simple, 20-wavelength, slotted-waveguide array is described in detail from its original design through X- and S-band model tests and its final full-scale fabrication to flight test at three different problem sites. Author

N66-15191# Joint Publications Research Service, Washington, D. C.
HYDROACOUSTIC COMMUNICATIONS SYSTEM WITH PULSE-TIME SIGNAL MODULATION
B. V. Shekhvatov 7 Jan. 1966 25 p refs Transl. into ENGLISH from Tr. Inst. Okeanol. (Moscow), v. 75, 1964 p 157–170
(JPRS-33651; TT-65-30095) CFSTI: $1.00

The advantages of a pulse-time signal modulation (PTM) system for transmitting telemetric information through a hydroacoustic channel are discussed. It is pointed out that the practical use of a PTM system in autonomous instruments is dependent on the creation of simple and highly accurate coders with a large dynamic range, and methods for converting the measured physical values into PTM code signals are considered. These include obtaining information on the parameter to be determined; coding of the signal; and sending the coded signals over an acoustic transmitter. Operational principles are described, and details are given on temperature and salinity measurements. Methods for determining the accuracy of scanning conversion systems are also described and the principal elements of the frequency conversion system are identified as the time unit and the electrical pulse counter. Methods for recording PTM code signals are compared. Results indicate that the use of instruments operating on the scanning conversion principle makes it possible to discriminate a useful signal against a background of impulse noise considerably exceeding the level of the working signal in frequency and intensity. M.G.J.

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N66-14396# Stanford Research Inst., Menlo Park, Calif.
GRAPHICAL-DATA-PROCESSING RESEARCH STUDY AND EXPERIMENTAL INVESTIGATION Quarterly Progress Report No. 8, 1 May–31 Jul. 1965
A. E. Brain, R. O. Duda, and J. H. Munson Aug. 1965 39 p ref
(Contract DA-36-039-AMC-03247(E))
(Rept.-20; AD-623280) CFSTI: HC $2.00/MF $0.50

A method for making a mask-plate for the 1024-image preprocessor is described in detail. The masks are organized in pairs and with the appropriate circuitry function as edge-detectors. Recognition experiments on hand-drawn map symbols parallel to those previously reported for the 100-image preprocessor have been carried out using the 1024-image preprocessor. In order to extend the work on mask design by simulation, it is desired to input a low-resolution TV picture into the SDS 910 computer. The standards chosen are 24-line and 120-line. Seven methods for interfacing the TV camera ouptut with the SDS 910 have been exsmined. The shift-register method has been selected for implementation. Author (TAB)

N66-14431# Pennsylvania Research Associates, Inc., Philadelphia.
INVESTIGATION OF DIGITAL CARTOGRAPHIC TECHNIQUES Final Report, Apr. 1964–May 1965
Griffiss AFB, N. Y., RADC, Oct. 1965 240 p refs
(Contract AF 30(602)-3393)
(RADC-TR-65-191; AD-623661) CFSTI: HC $6.00/MF $1.25

An investigation has been conducted into the feasibility and practicality of developing digital techniques for consolidation and reduction to a common data base of all information required for the production of charts and allied products. To explore this question a conceptual system (the Universal Cartographic Data Base) was defined and developed sufficiently to provide a basis for evaluation. Development of the UCDB entailed system analysis, programming research and experimentation with sample programming techniques. Evaluation of the UCDB indicates that the concept is both technically and economically feasible. Author (TAB)

N66-14437# Lowell Technological Inst. Research Foundation, Mass.
FOURIER ANALYSIS COMPUTER PROGRAM Scientific Report No. 1, 1 Jun. 1964–1 Jun. 1965
Walter G. Hartung May 1965 58 p refs
(Contract AF 19(628)-1696)
(AFCRL-65-552; AD-622413) CFSTI: HC $3.00/MF $0.75

This report discusses an IBM 7090-7094 computer program written in FORTRAN to analyze the period components of a time series function and compute the integrated power of these components by Fourier techniques. The theoretical considerations of Fourier analysis are presented in sufficient detail for an understanding of the computer program developed. Also described is the operation and use of the program. An example is presented which summarizes and illustrates the computer program. Author (TAB)

N66-14460# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW DEVICE FOR SOLVING INTEGRAL EQUATIONS
A. F. Verlan 7 Oct. 1965 7 p refs Transl. into ENGLISH from Avtomatika i Priborostr. (Kiev), no. 3, 1964 p 24–25
(FTD-TT-65-1023/1+2+4; AD-623209) CFSTI: HC $1.00/MF $0.50

A computer device of the analog type for solving integral equations is described. The device contains ordinary electronic resolving elements and permits the solution of a wide range of integral equations both linear and nonlinear. The operation of the device is illustrated by solving a linear Fredholm equation of the second type. The solution is sought in the form of a step polynomial. The device consists of a generator of functions of the solution, an integral transformation block, and a block for computing the integral from the absolute value of the residual. The device operates in a regime of periodization which is assured by the control circuit of electromechanical relays. The solution time depends on the complexity of the problem and varies from several tens of seconds to 15 minutes. The accuracy of results obtained using this device depends on the smoothness of the sought function. The largest relative error referred to maximum value is from 1 to 10%. E.E.B.

N66-14478 Joint Publications Research Service, Washington, D. C.
PRELIMINARY TRANSFORMATION DEVICE FOR SPEECH RECOGNITION

V. G. Zaytsev and B. B. Timofeyev *In its* Res. in Cybernetics 9 Dec. 1965 p 8–17 refs (See N66-14476 05-10) CFSTI: $3.00

A device is described for inserting and preliminarily processing spectrum-time sound input signals. The device basically consists of an amplitude normalizing unit, a speech detector, a computer, a coupler to the computer, an analog code converter, a pulse counter, and a delay device. A block diagram is given, and the description is made by explaining the sequence of events. A line diagram of the filter, and schematics of the speech detector and delay device are included. C.T.C.

N66-14540# Illinois Univ., Urbana. Dept. of Computer Science.
GRAPHICAL PROCESSING USING HYBRID ANALOG-DIGITAL CIRCUITRY
David P. Casasent 30 Aug. 1965 78 p refs
(Contract Nonr-1834(15))
(Rept.-187; AD-623261) CFSTI: HC $3.00/MF $0.75

By assigning analog voltages to the coordinates of a graph, drawings can be electrically displayed. By means of a sine-cosine potentiometer, resistance chains, and diamond gates with appropriate gate signals from digital counters, these drawings can be transformed (i.e., translated, rotated, magnified). Resistive summing networks and compensated current amplifiers provide the translation, while an ultralinear voltage amplifier achieves the magnification. This ultralinear voltage amplifier consists essentially of two two-stage amplifiers feeding a constant-current pre-output stage with negative feedback applied to the first stages. Thermal and nonthermal parameter variations are compensated for by a linearization of the used portions of the power dissipation and V_{ab} versus i_c curves, the constant current output stage, and circuit compensating transistor pairs. This topology produces an amplifier with a gain constant within 0.33 percent, a 20 volt output range, a drift and offset voltage of less than 9 mv, and a frequency response of d-c to 1 mc with a square wave input. It can supply 10 ma at all voltage levels with an error of less than 16 mv. Component replacement is possible with no loss of accuracy. Author (TAB)

N66-14563# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
DESCRIPTION OF AN/UYK PROGRAM FOR POINTING DATA FOR 60 FOOT DISH USING KEPLER ELEMENTS
Larry L. Warnke 5 Mar. 1964 51 p
(Contract NOw-62-0604-c)
(CF-3074; AD-622485) CFSTI: HC $2.00/MF $0.50

The AN/UYK Program for pointing data for the 60 foot dish using Kepler elements is utilized for generating a paper tape with the proper format which can be fed into the equipment controlling the 60 foot dish antenna and point it in the proper direction at the desired time. This program would be used when the data is not available from the 7090 complex for the operation of the injection station. It could also be used to track a satellite, whose orbit is defined by Kepler parameters, which is not within the normal operational scope of the injection station. TAB

N66-14581*# General Dynamics/Convair, Huntsville, Ala.
SIMULATION OF SELECTED DISCRETE NETWORKS. VOLUME TWO: USER REFERENCE GUIDE DISCRETE NETWORK SIMULATION PROGRAMS Final Report
Sep. 1965 77 p
(Contract NAS8-20016)
(NASA-CR-69010; GD/C-DDF-65-005) CFSTI: HC $3.00/MF $0.75 CSCL 09B

A users reference manual is presented which describes the Discrete Network Simulation (DNS) computer programs to the programmer. The prime purpose of DNS is to provide a set of analytical tools capable of conducting thorough, accurate, and rapid analysis of complex systems; and these programs provide a realistic analysis and prediction of system performance before or after the hardware system is constructed. The system modeled for the simulation may be a switching circuit, man/machine interaction, or any network where the component or subcomponent interrelations may be defined logically. C.T.C.

N66-14593# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OUTER SPACE AND CYBERNETICS
A. Prokhorov and I. Zakharov 20 Sep. 1965 11 p Transl. into ENGLISH from Zarya Vostoka (USSR), 18 Aug. 1962 1 p
(FTD-65-1147/1+4; AD-622463)

A brief discussion is presented of cybernetics and its role in space technology. Some possible functions in future missions are cited, and mention is given to areas where it can be applied. These include communications systems, space flight, data processing, computers, and astronaut selection. C.T.C.

N66-14746# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ANALOG AND DIGITAL COMPUTER ANALYSIS OF THE RANDOMLY EXCITED DUFFING EQUATION
Gene D. Bowling (M.S. Thesis) Aug. 1965 114 p refs
(GE/EE/65-5; AD-622697) CFSTI: HC $4.00/MF $0.75

Analog and digital computer techniques are used to measure the autocorrelation of the low frequency response of the non-linear Duffing equation excited by Gaussian white noise. An analog computer was used to simulate the Duffing equation, to create the time delay by simulating a modified form of the Pade Approximation, and to calculate the autocorrelation. The autocorrelation and power spectrum were calculated on a digital computer using the output from the Duffing equation simulated on the analog computer. The autocorrelation results are presented graphically. The autocorrelation was determined for two values of input noise voltage level, for under-damped and over-damped cases, and for values of the coefficient of the nonlinear term B, of 0.0.01, 0.1, 1.0, and 10.0. The mean square value of the response is reduced in amplitude and the autocorrelation curve approaches the zero axis at a faster rate when either the inout noise voltage level or the value of B is increased. A comparison of the measured and theoretical values when B is equal to zero show the analog computer results to be very accurate and the digital computer results to be less accurate. Author (TAB)

N66-14783*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
ON THE DETERMINATION OF OPTIMUM COMMAND ADDRESS CODES
Walter D. Davis Oct. 1965 24 p refs
(NASA-TM-X-55353; X-521-65-504) CFSTI: HC $1.00/MF $0.50 CSCL 09D

In order to minimize the probability of a spacecraft being addressed erroneously by the transmitted command address code of another spacecraft, an analysis has been conducted on the determination of optimum command address codes. The criteria used in this analysis for determining optimum command address codes are: (1) the Hamming distance; and (2) the code subsequences. In general, for a given word length, the aforementioned probability of error decreases as the Hamming distance increases. For two or more word lengths, the probability of error also decreases as the code subsequences (of each

command address code), which are identical to command codes, decrease. It is shown and/or proven that the number of command address codes is reduced as: (1) the Hamming distance increases; and/or (2) the code subsequences, which are identical to command address codes, decrease. Author

N66-14797# Franklin Inst., Philadelphia, Pa. Center for Naval Analyses.
THE USE OF SEARCH MEMORIES IN AUTOMATIC TRACKING
Henry Bobotek and Glenn G. Webb 14 Oct. 1965 80 p refs *Its* OEG Study 696
(Contract Nonr-3732(00))
(AD-623090) CFSTI: HC $3.00/MF $0.75

The use of a search memory for correlation in automatic tracking in track-while-scan systems is examined. Several memories, some previously proposed by industry and some suggested here, are compared and the types suitable for single- and multiattempt correlation are identified. An inherent requirement for frequent changing of stored information makes some memories undesirable, and the impact of this requirement should be carefully examined whenever an application of search memory is considered. Author (TAB)

N66-14948# Harry Diamond Labs., Washington, D. C.
FLUERICS (FLUID AMPLIFICATION). 9: FLUID DIGITAL LOGIC ELEMENTS AND CIRCUITS
Joseph M. Iseman 18 Aug. 1965 45 p refs Supersedes HDL-TR-1114
(HDL-TR-1302; HDL-TR-1114; AD-623565) CFSTI: HC $2.00/MF $0.50

At the heart of any digital system are the logic elements. The algebra governing these devices, the AND, OR, NAND, NOR, flip-flop and others, has been established and is well known in electronic control and computer systems. There are fluid circuits that can satisfy the same algebraic rules for any digital logic system. A systemized treatment of the basic wall-effect fluid combinatorial and sequential elements as well as some systems studied to date is presented. Author (TAB)

N66-14983 Joint Publications Research Service, Washington, D. C.
ON A PATTERN RECOGNITION ALGORITHM
A. G. Frantsuz *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 103–116 refs (See N66-14976 05-10) CFSTI: $6.00

An algorithm is investigated for learning to recognize shapes made up of minimization of the description (reduction to separation without selection of a subspace which is optimal in some sense), and construction in this subspace of a local decision rule. The structure of the algorithm is investigated in detail for the space of the descriptions with binary coordinates. The algorithm has comparatively simple structure and permits ensurance of the practical possibility of recognition for large size descriptor space and on varying the nature and configuration of the regions of the classes in the descriptor space within quite wide limits. Some analogies are noted between the operation of the algorithm and the procedure of recognition of the shapes by a man. Author

N66-14984 Joint Publications Research Service, Washington, D. C.
CALCULATION OF THE PROPERTIES OF RECOGNITION SYMBOLS
Yu. L. Barabash *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 117–127 refs (See N66-14976 05-10) CFSTI: $6.00

The influence of certain properties of features of objects on the amount of information received when recognizing them is investigated. Author

N66-15098# Bettis Atomic Power Lab., West Mifflin, Pa.
AUTOMATION OF MASS SPECTROMETERS FOR ISOTOPIC ANALYSIS OF REACTOR MATERIALS
F. B. Barker, H. D. Cook, and J. E. Hudgens 12 Feb. 1965 16 p refs Presented at the 149th Natl. Meeting of the Am. Chem. Soc., Detroit, 4–9 Apr. 1965
(Contract AT(11-1)-GEN-14)
(WAPD-T-1769; CONF-650401-14) CFSTI: HC $1.00/MF $0.50

A description is given of a versatile on-line computer system which was developed for automatically controlling the mass spectrometer during the data acquisition phase, and simultaneously reducing the data and converting it to the desired form. The functions of the system and the programs for thermal emission and spark-source mass spectrometers are described. NSA

N66-15122# Library of Congress, Washington, D. C. Aerospace Technology Div.
COMPUTER TECHNOLOGY Surveys of Soviet Scientific and Technical Literature
Stuart Hibben and Boris Doncov 1 Nov. 1965 94 p refs Compilation of abstracts *Its* Rept.-3
(ATD-P-65-97)

An annotated bibliography is presented on Soviet developments in computer technology with references to components, design, applications, and associated systems. The appendix includes a review of a theoretical study on microminiaturization of electronic elements. The study deals with the behavior of the living molecular organism and the use of this behavioral information in producing electronic storage elements consisting of individual atoms and molecules. The possible approaches to experimentation are outlined. R.N.A.

N66-15187# Michigan Univ., Ann Arbor. Coll. of Literature, Science, and the Arts.
A HOMOMORPHIC THEORY OF CONTEXT-FREE LANGUAGES AND ITS GENERALIZATIONS
Yehoshafat Give'on Sep. 1965 31 p refs *Its* Rept.-07363-03105-40-T
(Contract Nonr-1224(21); Grant DA-ARO(D)-31-124-G665) (AROD-4049-16) CFSTI: HC $2.00/MF $0.50

Usually, and naturally, context-free languages are defined and studied by means of grammars. In the course of study of these languages several algebraic characterizations were found. In this paper one of these characterizations (namely, the homomorphic characterization that was established by Chomsky and Schutzenberger (N. Chomsky and G. A. Miller, 'Introduction to Formal Analysis of Natural Languages,' 'Handbook of Mathematical Psychology, II, J. Wiley, p. 269–418, 1963)) is regarded as the definition of this family of languages and it is shown how one can derive some of their well known properties directly from this 'redefinition.' In addition to simplification of proofs, the arguments involved lead naturally to some generalizations that have some bearing on mathematical linguistics. The families of languages derived by means of these generalizations exhibit some features which are too complex for the context-free model and yet these features are of the type that one encounters in the study of natural languages. Examples of these generalizations are discussed. Author (TAB)

N66-15188# Rome Air Development Center, Griffiss AFB, N. Y. Information Processing Branch.
UNIVERSAL PRINT READER TECHNIQUES, VOLUME II Final Report
R. B. Greenly, K. K. Maass, J. W. Meyer, and S. A. Michalik Oct. 1965 392 p
(RADC-TR-64-374, Vol. II; AD-623614) CFSTI: HC $7.00/MF $1.75

Volume II presents the electronic masks of all characters in the Boldface no. 16, Artisan 10, Underwood Financial Gothic, Modified Manifold 12, and an American Standards Association Candidate font for optical character recognition. The significance of this data is that a convolution of any encoded character with the total form of any other character in the same vocabulary group will result in a mimumum of five color differences (exceptions are noted) at the coded locations. Additionally, the stability of each encoded location has been proven by statistical research using actual type samples and electronic data processing aids. Author (TAB)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N66-14347# Radio Corp. of America, Somerville, N. J. Electronic Components and Devices.
TRANSISTOR, FIELD EFFECT, INSULATOR GATE, 100-MC AMPLIFIER Quarterly Progress Report, 1 Apr.–30 Jun. 1965
R. Dawson and M. Mitchell [1965] 26 p ref
(Contract DA-28-043-AMC-00314(E))
(QPR-4; AD-623403) CFSTI: HC $2.00/MF $0.50

The present devices have power gains of 18 to 24dB at 100mc operating at V_D= 6 volts and I_D= 2 ma. Noise figures average about 2.5dB. Average gate breakdowns are 85 volts; while the source-drain breakdowns average 20 volts. AGC and cross modulation characteristics are excellent. Noise measurements confirm the theory as predicted by Jordan and Jordan and exhibit a low pass roll off which occurs in the 10 to 100Mc region. TAB

N66-14414# Radio Corp. of America, Camden, N. J.
THE VALIDATION OF A MAINTAINABILITY PREDICTION TECHNIQUE FOR AN AIRBORNE ELECTRONIC SYSTEM Final Report, Jan.–Sep. 1964
B. L. Retterer, G. H. Griswold, R. L. Mc Laughlin, and Donald A. Topmiller Wright-Patterson AFB, Ohio. AMRL May 1965. 70 p refs
(Contract AF 33(615)-1338)
(AMRL-TR-65-42; AD-622804) CFSTI: HC $3.00/MF $0.75

A technique for predicting the maintainability, at the field maintenance level, of airborne electronic equipment was investigated. In the technique, which was based on one previously developed for ground electronic systems, design features, skill requirements, facilities and the maintenance environment are used to predict maintenance times. Predictions of elemental task-times involved in maintaining the AN/APX-46 airborne IFF were computed from ratings made independently by Air Force and contractor (RCA) personnel. These predictions were compared with each other and with data collected under field conditions in which malfunctions were artificially introduced. The two independent predictions of overall down time were in close agreement with each other, however, there was little agreement between the elemental task-time predictions. Although the fieldcondition data were limited, the analyses suggest that the prediction equation would tend to overestimate actual times. On the basis of this study it cannot be concluded that the technique, as used, accurately predicts maintenance down-time of airborne electronic equipment. However, it appears that portions of the technique could be used to evalute the relative maintainability of alternative designs. Suggestions for modifying the techniques and for improving the predictions are presented. Author (TAB)

N66-14430# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FULL-WAVE MAGNETIC PULSE-WIDTH MODULATOR
V. L. Bunakov and R. G. Gasparov 3 Jun. 1965 6 p transl. into ENGLISH from Soviet Patent no. 159197 (Appl. no. 778385/26-9, 14 May 1962) 2 p
(FTD-TT-65-180/1+2; AD-620091) CFSTI: HC $1.00/MF $0.50

Object of the invention: A full-wave magnetic pulsewidth modulator with a power supply of direct current consisting of two saturation chokes with widings connected to a source of control voltage, which is distinguished by the fact that for the purpose of simplifying the device, improving the dependability of its operation, and extending the range of width of the pulse on the input signal, on the input of the device there is connected a key, for example a semiconductor triode (transistor) controlled on the basis of pulses with a duty factor of 0.5, the output of which through ballast resistance is connected to the negative pole of a source of direct current, and at the same time to the general point of sequence-connected saturation chokes connected up to a source of direct current through stabilitrons with a voltage of stabilization of $U_{(stab)}$ ($U_{(final)}/2$). (TAB)

N66-14462# Naval Radiological Defense Lab., San Francisco, Calif.
THE INFLUENCE OF TEMPERATURE ON RADIATION-INDUCED SURFACE EFFECTS IN TRANSISTORS
Clarence F. Ramstedt, Harry A. Zagorites, and Dan Y. Lee 5 Aug. 1965 180 p refs
(USNRDL-TR-885; AD-623078) CFSTI: HC $5.00/MF $1.00

Tests were performed to determine the influence of junction temperature on radiation-induced surface effects in transistors. Sets of the germanium transistor types 2N526, 2N501A, 2N43A and 2N599 and the silicon transistor type 2N329A were irradiated to an exposure of 13,100 r in controlled ambient temperatures of 0, 25, and 50C while individual I_{CBO} (collector leakage current), β (common emitter current gain) and h_{ie} (common emitter input impedance) levels were measured. The responses, predominantly upward, were shown to be significantly dependent on junction temperature. The radiation-induced changes in I_{CBO} (δ I_{CBO}) increased with temperature in all units up to a point, above which, in three Ge types, they decreased. Induced changes in gain (δ β) showed no consistent temperature influence; but, analysis of the common base gain, α, showed changes (δ α) which decreased consistently with temperature in the Ge transistors and over a portion of the temperature in the Si transistor. The responses of h_{ie} generally followed those of β. Thermal annealing of radiation effects appears responsible for the diminishing of δ α and δ I_{CBO} with temperature. Post-irradiation recovery rates of δ I_{CBO} increased with temperature and correlated with the δ I_{CBO} vs temperature relations. No correlation could be established between the δ β vs temperature relation and the post-irradiation recovery rate of current gain. Author (TAB)

N66-14474# Army Electronics Labs., Fort Monmouth, N. J.
FACTORS AFFECTING TRANSISTOR FAILURE IN DC TO DC CONVERTERS
Bernard Reich Jul. 1965 14 p ref
(ECOM-2620; AD-623359) CFSTI: HC $1.00/MF $0.50

The purpose of this report is to indicate assignable causes of failure of transistors in dc to dc converters. While seemingly power transistor converter failures occur with no apparent cause after many cycles of operation, an examination of the load characteristics can reveal a potential failure pattern. The load line characteristic coupled with the safe area limits of the transistor has revealed potential failure patterns in converters described in this report. This analysis has lead to a much better understanding of transistor failures observed with the types of converters analyzed. Author (TAB)

N66-14494# Naval Air Development Center, Johnsville, Pa.
FEASIBILITY OF LOW POWER ANNEALED MAGNETIC FILMS Final Report
S. B. Greenberg 30 Aug. 1965 27 p refs
(NADC-AE-6503; AD-621939) CFSTI: HC $2.00/MF $0.50

The feasibility of using annealed low power thin permalloy films for information storage in computer memories was demonstrated. A memory exerciser was designed and built for simulation of memory operation. The optimum post-deposition anneal of 10 minutes at 300 C in a magnetic field along the transverse axis produced a reduction of 1/3 to 1/2 in read-drive current to as low as 200 ma without increasing the dispersion enough to make the films unusable. The switching time of annealed films was several nanoseconds, approximately the same as that for unannealed films. The annealing process was also shown to be useful for a 'bicore' type nondestructive readout film device. Author (TAB)

N66-14507# Ohio State Univ., Columbus.
THE CONSTRUCTION OF A LITHIUM DRIFTED GERMANIUM SOLID STATE DETECTOR SYSTEM WITH SPECIAL ATTENTION TO Ag^{105} AND Ir^{192}
Robert Allen Dessert (M.S. Thesis) 1965 71 p refs
(Contract AF 33(608)-1095)
(AD-620434) CFSTI: HC $3.00/MF $0.75

A relatively inexpensive cryostat was constructed for operation of lithium drifted germanium gamma ray detectors at pressures below 0.0000001 mm of Hg and at 77K. Fundamental data was obtained on a Li drifted Ge detector, including relative counting efficiency, resolution and peak to total ratio. The spectra of Ir^{192} and Ag^{105} were investigated using the solid state detector. A technique of segmentation and expansion of energy subgroups with a multichannel analyzer is offered as a means to provide more points in a given peak of a spectrum taken on the detector. TAB

N66-14521# Burndy Corp., Norwalk, Conn.
PRODUCTION ENGINEERING OF TRIAXIAL PULSE CONNECTORS Quarterly Report, 1 Apr.–30 Jun. 1965
Mark L. Auriana 9 Aug. 1965 13 p
(Contract DA-36-039-SC-85964)
(QR-10; AD-623176) CFSTI: HC $1.00/MF $0.50

Five engineering samples (plugs and receptacles) for RG-156/U Cable were manufactured per SKM15357. Qualification testing of these 5 units was begun. A mechanical aid, in the form of a positive, bi-directional mechanical stop should be incorporated in the design of the receptacle insert holding area. This would prevent loosening of the insert when the connectors are inadvertently mated with excessive force. TAB

N66-14537# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PARALLEL L-C TUNED CIRCUIT EMPLOYING A LIGHT-VARIABLE CAPACITOR
Joseph Charles Wheeler (M.S. Thesis) Aug. 1965 84 p refs
(GE/EE/65-25; AD-623101) CFSTI: HC $3.00/MF $0.75

A modified Schering bridge circuit was used to measure the resistance and capacitance of a metal-oxide semiconductor capacitor (MOSC) illuminated by a 500 watt tungsten-filament lamp. An increase in capacitance ranged from 55% at .6 mc to 4% at 40 mc with light, and the quality factor ranged from a peak of 65 at 12 mc with no light to a peak of 6.5 at 30 mc with light. For small frequency variations around the peak values of Q the MOSC had constant characteristics and could be used as a light tunable capacitor in a parallel L-C circuit. Author (TAB)

N66-14571# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
GUIDE FOR MICROELECTRONIC CIRCUIT AND SYSTEM DESIGN
Stanley H. Gordon 17 Mar. 1964 48 p refs
(Contract NOw-62-0604-c)
(CF-3072; AD-622487) CFSTI: HC $2.00/MF $0.50

The paper presents information necessary for an electronic designer to begin to design microelectronic circuits and systems. The information falls into three categories: fabrication of microelectronic circuits, characteristics of the various microelectronic approaches and circuit or system design rules for each of the various microelectronic approaches. TAB

N66-14586# Harry Diamond Labs., Washington, D. C.
HIGH-G TIME BASES
Henry P. Kalmus 16 Aug. 1965 23 p
(HDL-TR-1299; AD-622630) CFSTI: HC $1.00/MF $0.50

For many military applications, low frequency oscillators ($\approx$ 100 Hz) are required which maintain their frequency within 5 parts in 10,000 after they have been exposed to an acceleration of 30,000 g for 100 ms, and also after a storage period of 5 yr. In addition, the same stability must exist over the total military temperature range while a constant acceleration of, say, 5000 g in any direction is applied for about 200 sec. The characteristics of mechanical systems and various electrical circuits proposed for the time bases will be summarized. It will be shown that oscillators, based on the use of RC networks and solid state negative feedback amplifiers, can fulfill the requirements. It will also be shown that, for cost reduction, the conventional amplitude control over many cycles can be replaced by an instantaneous limiter without detrimental effects on stability. Author (TAB)

N66-14597# National Co., Inc., Melrose, Mass.
PRODUCTION ENGINEERING MEASURE FOR CESIUM BEAM TUBES Quarterly Progress Report, 23 Feb.–23 May 1965
James George [1965] 37 p
(Contract DA-36-039-AMC-01457)
(QPR-8; AD-622437) CFSTI: HC $2.00/MF $0.50

The life test of the retrofitted PEM-E3 cesium beam tube was continued with satisfactory results. With two exceptions, the new PEM-E6 tube successfully withstood environmental testing. System evaluation of the new PEM-E5 and PEM-E6 tubes in tri-service atomic frequency standards disclosed that the signal-to-noise ratios of these tubes were inadequate for the bandwidth of the electronics. Redesign of the tubes was

completed. The quality assurance division continued preparation of test procedures, tube specifications, and processing instructions for the manufacturing phase of the PEM program. Release of drawings to the manufacturing division was continued during this reporting period. Author (TAB)

N66-14610# Royal Aircraft Establishment, Farnborough (England).
REDUNDANCY IN DIGITAL SYSTEMS
F. A. Inskip Sep. 1965 42 p refs
(RAE-TR-65201) CFSTI: HC $2.00/MF $0.50

A number of methods of using redundancy in digital systems is described. Numerical values of reliability are given for a small system of the order of size typical of a satellite data handling system. Two values of reliability are given; one using the best values of component reliability available at the present time and the other using an order lower. Author

N66-14662# Atomic Energy of Canada Ltd., Chalk River, (Ontario).
AN AUTOMATIC CONTROL SYSTEM FOR ANODIC OXIDATION PROCESSES
D. A. S. Walker Sep. 1965 18 p refs
(AECL-2502; CRC-1223) CFSTI: HC $1.00/MF $0.50

A system capable of delivering a constant current over the range of 10 μA to 230 mA at voltages up to approximately 500 volts was developed. Apparatus for automatically controlling given conditions were designed and put into operation. An electrometer, which monitors the potential difference between the anode and reference electrode, supplies a current signal to an optical meter relay which incorporates an adjustable trip level feature. When the potential difference equals the preset trip level, a suitable bucking voltage was applied to the reference electrode by means of a chain of precision resistors mounted on one bank of a stepping relay. It was noted that when the bucking voltage equals the desired final voltage the electrolytic process stops. R.W.H.

N66-14663# Texas Instruments, Inc., Dallas. Apparatus Div.
MODIFICATION OF ASR-4 RADAR INDICATOR TO PROVIDE BRIGHT DISPLAY OF RADAR, BEACON, ALPHA-NUMERIC AND SYMBOLIC DATA Final Report
John F. Berglund Mar. 1965 118 p
(Contract FA-WA-4178)
(SRDS-RD-65-42; SP8-A65)

This final report describes the design, fabrication, installation, and testing of an ASR-4 bright display subsystem. The objective of this contract was to develop modification kits for the ASR-4 display subsystem to provide (1) bright display of radar video, (2) display of a slew dot and the generation of a beacon readout trigger, (3) display of asynchronous beacon or radar video, (4) display of computer-derived alpha-numeric and symbolic data, and (5) generation of digital message formats for transfer of data to a display computer. These functions were developed as separate modification groups compatible with step-by-step implementation. These modifications were incorporated in a two-console display subsystem which was successfully installed and tested as part of the Advanced Radar Traffic Control System (ARTS) at the Atlanta Terminal Area Tower. Author

N66-14665# Southampton Univ. (England). Dept. of Electronics.
ELECTRONIC CIRCUIT PERFORMANCE USING ANALOGUE TECHNIQUES WITH REFERENCE TO COMPONENT TOLERANCE Progress Report, Jul.–Dec. 1964
B. H. Venning and R. A. Rathmell [1964] 50 p
(Contract PD/40/024/R1) CFSTI: HC $2.00/MF $0.50

Investigations may be summarized as follows: (a) resistive parameter distributions for various types of currently manufactured resistors such as carbon composition, metal film and metal oxide types, and the various parameters which affect the performance of these components; (b) design and development of a suitable random amplitude distribution equipment for the simulation of tolerance conditions in electronic circuits with particular regard to reliability of operation and simplicity in the setting up procedure; (c) design of a pulse amplitude discriminator circuit for the purpose of analyzing the output waveform of the random amplitude distribution equipment, and the output waveform from the simulated circuit in the computer; and (d) investigation of suitable equipment for analyzing the output data from the computer and automatically presenting this data in a suitable form for further analysis. Author

N66-14714# Carnegie Inst. of Tech., Pittsburgh, Pa. Dept. of Electrical Engineering.
STUDIES OF Ge–GaAs AND Ge–Si HETEROJUNCTIONS Interim Technical Report
Joseph P. Donnelly Sep. 1965 269 p refs
(Contract DA-31-124-ARO(D)-131)
(AROD-3397-8; AD-623842) CFSTI: HC $6.00/MF $1.25

The electrical and photovoltaic characteristics of Ge–GaAs and Ge–Si heterojunctions were investigated. It was found that interface states play an important role in these junctions. Theoretical estimates of the number of interface states indicate that these states have only a secondary effect on the equilibrium band diagram of Ge–GaAs junctions. This was verified by capacitance measurements. On the other hand, interface states completely dominate the band diagram of Ge–Si junctions. Tunneling and recombination currents were found to be the dominant transport mechanism in p–n Ge–GaAs and Ge–Si heterojunctions. The theoretical capacitance of abrupt heterojunctions including the effects of interface states were developed. The results show that interface effects depend on the bulk impurity concentration and their ratio as well as the density and distribution of interface states. Good agreement was obtained between this theory and experimental results. A frequency dependent capacitance term, which is due to the rate limited charging and discharging of the interface states, was observed on several Ge–Si junctions. Photovoltaic measurements indicate that minority carriers generated in the narrow band gap material recombine at the interface. This effect usually nullifies any advantage obtained from the 'window' effect. Author (TAB)

N66-14733# Reeves-Hoffman Div., Dynamics Corp. of America, Carlisle, Pa.
SINGLE SIDEBAND QUARTZ CRYSTAL UNITS FOR VHF APPLICATIONS METAL ENCLOSURES First Quarterly Progress Report, 15 May–Jul. 1965
George E. Ritter [1965] 52 p
(Contract DA-28-043-AMC-01325(E))
(Rept.-1; AD-623716) CFSTI: HC $2.00/MF $0.50

Coldweld enclosure parts of the HC-6 and transistor-configuration which will withstand high bakeout temperatures are difficult to secure. Some brazing is being attempted and design of the two types of enclosures utilizing a compatible glass-to-metal seal is underway. Preliminary tests using the thermocompression bonding apparatus resulted in a need for modification of the equipment. Several attempts were made using glass bonding techniques with one bond producing favorable results. Quartz resonator designs have been initiated. Author (TAB)

N66-14744# Knights (James) Co., Sandwich, Ill.
PRODUCTION ENGINEERING MEASURES: VHF QUARTZ CRYSTAL UNITS CR-(XM-38)/U 150 MC TO 200 MC Quarterly Report, 1 Jul.–31 Sep. 1964
[1964] 35 p
(Contract DA-36-039-SC-85973)
(QR-6; AD-622561) CFSTI: HC $2.00/MF $0.50

The parameters of preproduction samples of the overtone units, 150 mc, 162 mc, 174 mc, 188 mc, and 200 mc are given, and adjusting ultra-high frequency units to frequency with evaporated gold is discussed. Author (TAB)

N66-14749# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE USE OF METAL-OXIDE-SEMICONDUCTOR FIELD EFFECT TRANSISTORS (MOST) IN COMPLEMENTARY CONFIGURATIONS
Roger Andre Gagnon (M.S. Thesis) Aug. 1965 83 p refs
(GE/EE/65-9; AD-622424) CFSTI: HC $3.00/MF $0.75

The metal-oxide-semiconductor field effect transistor (MOST) extends scope of complementary circuits because the enhancement device conducts under different (but complementary) conditions from those of the depletion device. Twenty-two MOST equivalents to ten existing bipolar complementary configurations were found in a nonexhaustive comparison. An empirical equation was found for the MOST characteristics. One typical configuration was analyzed using the empirical equations with good comparison to test results. Five applications of the configuration were investigated: A.M. modulator, pulse amplitude modulator, multiplier, amplifier with a voltage controlled gain (positive or negative), and product detector. Author (TAB)

N66-14800# General Dynamics Corp., San Diego, Calif. Special Nuclear Effects Lab.
TRANSIENT RADIATION EFFECTS ON ELECTRONIC PARTS Final Report, 16 Jun. 1964–14 Jun. 1965
V. A. J. van Lint, R. F. Overmyer, and D. K. Nichols 10 Jul. 1965 94 p refs
(Contract DA-36-039-SC-89196)
(GA-6534; AD-623904) CFSTI: HC $3.00/MF $0.75

Prompt and delayed conductivity in mica, ceramic, tantalum oxide, and mylar dielectrics with various types of electrodes under linac irradiation are reported. Fast neutron-induced conductivity of a mylar capacitor irradiated in the triga reactor is found to be $=4.4 \times 10^{-27}$ ($NV^{0.95}$. A theory of neutron induced ionization in insulators has been formulated which predicts linear dependence of conductivity with neutron energy deposition rate. Data from irradiations of EG-58 aluminum coaxial cable at the triga reactor facility, at the sandia pulsed reactor facility, and with a 14-Mev neutron generator show that the saturated response of EG-58 is smaller than conventional RG-58 cable response. Ionized-gas experiments in a parallel-plate geometry indicate that a potential of -2.5 V is sufficient to repel approximately one-half the secondary electrons reaching the signal plate from nearby plates. A computer program describing the motion of holes and electrons in a p-n diode has been revised to describe the motion of electrons and ions in an ionized gas in parallel-plate geometry under an applied field. Author (TAB)

N66-14823# Bendix Corp., Davenport, Iowa. Pioneer-Central Div.
FREQUENCY TEMPERATURE COMPENSATION TECHNIQUES FOR QUARTZ CRYSTAL OSCILLATORS Quarterly Report, 1 Mar.–31 May 1965
R. H. Bangert 5 Aug. 1965 66 p refs *Its* Publ.-3392-65
(Contract DA-36-039-AMC-02282(E))
(QR-7; AD-624018) CFSTI: HC $2.00/MF $0.50

The work covered in this quarterly report involves the continued development of circuit techniques for the frequency temperature compensation of three quartz crystal oscillator groups, defined by specific frequency temperature stability characteristics by electronics command requirement SCL-6657 dated 13 October 1964. The characteristics of three basic oscillator configurations—common base, common emitter, and common collector—are discussed as a result of a preliminary investigation. Data is shown on the comparative performances of each, drive level effects on the frequency of a TCXO are shown for oscillators using a number of different crystals. A new computer approach based on the application of matrix techniques for the synthesis of compensation networks is discussed. The computer program is aimed at enabling complex networks to be synthesized with a minimum of effort.
Author (TAB)

N66-14843# Clevite Corp., Bedford, Ohio. Piezoelectric Div.
PRODUCTION ENGINEERING MEASURE FOR CERAMIC FILTERS Ninth Quarterly Report, 30 Mar.–29 Jun. 1965
A. Lungo [1965] 22 p
(Contract DA-36-039-AMC-01471(E))
(Rept.-9; AD-623717) CFSTI: HC $1.00/MF $0.50

A status report is presented on the fabrication of the production fixtures. Difficulties encountered in fabricating filter sub-assemblies at 1.75 Mc, 4.3 Mc, and 6.0 Mc are presented and discussed. Also, minor modifications to the cartridge designs are discussed which should lead to simplification of the filter assembly. Additional potential problem areas have appeared which are expected to add to the difficulties already anticipated in meeting contract specifications. These new problem areas are discussed. Author (TAB)

N66-14846# Solid Sate Radiations, Inc., Los Angeles, Calif.
NEUTRON DETECTION AND SPECTROSCOPY WITH SEMICONDUCTOR DETECTORS Final Report
M. R. Zatzick and E. L. Zimmerman Apr. 1965 123 p refs Revised
(Contract DA-18-108-405-Cml-1012)
(NDL-TR-54; AD-623722) CFSTI: HC $4.00/MF $0.75

Results are presented of a study of methods for utilizing diffused junction, semiconductor detectors in neutron detection and spectroscopy. The study resulted in the development of various neutron-sensitive coated detectors and the Li^6 epithermal neutron spectrometer system, which consists of a Li^6-sandwich detector and a complete, integrated electronic system. The techniques investigated for applying neutron-sensitive materials to detector surfaces included solution evaporation, vacuum evaporation, and electrodeposition. Solution evaporation is preferable when a thick coating of B^{10} or U^{235} is desired for maximum sensitivity. Vacuum evaporation is preferable when very thin uniform films of Li^6 and Li^6F are required on the detector surface. A thermal neutron source was used to observe the response of each coating material deposited on the detectors as a function of dead layer and radiator thickness. Theoretical relationships depending on range-energy relationships adequately predict the response of coated detectors as a function of converter material thickness, detector dead layer, and discriminator settings. The detector developed for the epithermal neutron spectrometer system consists of a layer of Li^6F sandwiched between two silicon detectors in a hermetically sealed package. Author (TAB)

N66-14847# Sprague Electric Co., North Adams, Mass.
DEVELOPMENT OF CONTROLLABLE SELECTIVE AMPLIFICATION IN SILICON-BASED MICROCIRCUITRY Interim Report, 15 Aug.–15 Nov. 1965
Robert S. Pepper [1965] 34 p
(Contract AF 33(615)-2914)
(IR-2; AD-623989) CFSTI: HC $2.00/MF $0.50

Characterization studies of the Mark IAGC block have been completed. Simulation of the Mark II block in integrated form has been achieved through the use of a special interconnection mask applied to the Mark I unit, evaluation of the simulated Mark II AGC block has begun. Development of a prototype stabilized gain block is continuing. It has been necessary to evolve a more comprehensive technique for evaluating the performance of the stabilized gain block, since first-order analysis yielded unsatisfactory results. Several models of the stabilized block have been built in integrated form, and evaluation of these devices has begun. A lowpass (video) amplifier has been breadboarded to verify the nested multiple-loop feedback design procedure. Evaluation of this breadboard model is under way.
Author (TAB)

N66-14848# Sprague Electric Co., North Adams, Mass.
FEASIBILITY STUDY OF METAL BASE TRANSISTOR Second Quarterly Report, 30 Apr.–31 Jul. 1965
J. J. Casey, F. L. Vogel, and P. M. Kennedy [1965] 23 p refs
(Contract DA-28-043-AMC-00168(E))
(Rept.-3; AD-623897) CFSTI: HC $1.00/MF $0.50

Techniques for obtaining $MoCl_5$ that is more highly purified for use as a vapor source have been developed and implemented. Deposits made with these sources have been investigated by electron diffraction and electron microscopy. Initial experiments have indicated that low temperature epitaxial growth of silicon layers will probably be feasible if growth uniformity can be maintained. Other experiments have shown that even very thin layers of deposited molybdenum retain their metallic character after being subjected to temperatures considered feasible for subsequent expitaxial growth. Measurement of photoresponse in molybdenum–silicon diodes has continued. Changes in the measurement equipment have engendered improved results, but measurements in the infrared spectrum still present difficulties in detection.
Author (TAB)

N66-14849# Radio Corp. of America, New York. Communications Systems Div.
HIGH PERFORMANCE THIN FILMS FOR MICROCIRCUITS (CAPACITORS) First Quarterly Progress Report, 1 Mar.–31 May 1965
Franz Huber and W. Witt 30 Jun. 1965 34 p refs *Its* Rept.-1
(Contract DA-28-043-AMC-01230(E))
(CR-65-419-22; AD-623851) CFSTI: HC $2.00/MF $0.50

A basic hafnium sputtering system was designed and constructed to accommodate a 6-1/2 in. × 6-1/4 in. Hafnium cathode. Sputtered hafnium films were deposited on microscope slides and anodized. Over 100 HF-HfO_2-Al capacitor structures were fabricated and tested. Capacitance per unit area, dissipation factor, and temperature characteristic measurements were taken at 1 kc/s, and the results of these measurements are presented with corresponding data on Ta_2O_5 and $La_2Ti_2O_7$ for comparison purposes.
Author (TAB)

N66-14865# General Telephone and Electronics Labs., Inc., Bayside, N. Y.
HOT-ELECTRON MILLIMETER DEVICES First Quarterly Report, 1 Jun.–31 Aug. 1965
R. I. Harrison, L. Cohen, F. Drago, D. Fleri, R. Socci et al
Ft. Monmouth, N. J., Army Electron. Command, Oct. 1965 19 p refs *Its* Rept.-1
(Contract DA-28-043-AMC-00492(E))
(ECOM-00492-1; AD-624055) CFSTI: HC $1.00/MF $0.50

A program is being conducted to explore the application of known hot-carrier effects in semiconductors to the development of new and improved microwave devices. The devices being investigated include modulators, mixers, harmonic generators, and detectors. An experimental technique was developed for measuring the modulation depth of the hot-carrier amplitude modulator at drive frequencies above 0.5 gc/s. Typically, modulation indices of 60 and 30 percent were obtained at 0.5 gc/s and 0.75 gc/s respectively. The hot-carrier InSb mixer exhibited a minimum detectable signal power of −96 dbm at 70 gc/s with a local-oscillator drive of −4 dbm at 78° K. Third-harmonic power at 210 gc/s was obtained with a p-type 35 ohm cm Ge hot-carrier unit. Hot-carrier detectors fabricated from 0.5 ohm cm P-type Ge exhibited essentially square-law response for power levels up to 10 mw at 70 gc/s. The sensitivity of the units is greater than 100 mv/mw.
Author (TAB)

N66-14921# Army Electronics Labs., Fort Monmouth, N. J. Electron Tubes Div.
A METHOD FOR DETERMINING KLYSTRON GAP CAPACITANCES
Arthur Gottfried and Arthur Wachtenheim Aug. 1965 19 p refs
(ECOM-2623; AD-623715) CFSTI: HC $1.00/MF $0.50

This report describes a perturbation method used to determine the gap capacitances of a two-gap, supported-drift-tube klystron. The effect of fringing fields on the capacitances is taken into account by perturbing the gaps with dielectric material. The method discussed in this report is applicable to either equal or unequal gaps.
Author (TAB)

N66-14925 Filtron Co., Inc., Flushing, N. Y.
INTERFERENCE REDUCTION GUIDE FOR DESIGN ENGINEERS, VOLUME I
Ft. Monmouth, N. J., Army Electron. Labs., 1 Aug. 1964 376 p
(Contract DA-36-039-SC-90707)
(AD-619666) CFSTI: HC $7.00/MF $1.75

As the design engineer must consider how the functional requirements of equipment are affected by interference characteristics, the necessary background information and techniques for minimizing interference generation and susceptibility are presented as a guide. The terms peculiar to interference engineering are defined and the general characteristics of interference are described. Interference sources are categorized as nautral, inherent, and manmade, and transfer media are identified as conducted or radiated interference. Electromagnetic compatability control and test plans are given as typical examples of the procedures necessary for determining radio frequency interference. Two approaches to interference reduction are discussed: initial design for optimum interference reduction (from electronic equipment design through final production), and application of remedial interference control measures after equipment has become operational. The first approach is given preference. Details are also given on design considerations for grounding, bonding, shielding, cabling, and equipment mounting.
M.G.J.

N66-15017*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PHOTON-ACTUATED MULTIPLEX SWITCH DEVELOPMENT

Daniel Bergens 15 Dec. 1965 28 p
(Contract NAS7-100)
(NASA-CR-69140; JPL-TR-32-794) CFSTI: HC $2.00/MF $0.50 CSCL 09A

A photon-actuated electronic switch has been developed for multiplexing low-level analog signals. The device represents a significant advance in this type of solid-state switching in terms of miniaturization, speed, simplicity, and potential reliability. The switch consists of a gallium arsenide diode, as an infrared light source, and a double-emitter silicon transistor that detects the infrared photons and acts as the switch. Efficient coupling between the diode and the transistor has been achieved. Device development, theoretical considerations, problem areas, and test results are covered. The report is a condensation of the final report, supplemented by test results and more user-oriented. Author

N66-15022# Mictron, Inc., Albany, N. Y.
C. W. X-BAND VOLTAGE TUNABLE OSCILLATOR Eighth Quarterly Progress Report, 1 Apr.–30 Jun. 1965
M. R. Boyd and M. Weinstein [1965] 22 p
(Contract DA-36-039-AMC-03270(E))
(Rept.-8; AD-622963) CFSTI: HC $1.00/MF $0.50

Tubes of the Design I approach were modified in accordance with experimental evidence that indicated that the major electronic interaction took place near the vane tips. Wide band performance at good power and efficiency has been achieved with these tubes. Increased control electrode voltage range, reduced emitter back heating and consistent performance are the areas to be refined. Author (TAB)

N66-15061# Union Carbide Corp., Parma, Ohio. Kemet Dept.
DEVELOPMENT OF THIN ORGANIC ROLLED FILM CAPACITOR Quarterly Progress Report, 1 May–31 Jul. 1965
[1965] 26 p
(Contract NObsr-89519)
(QPR-6; AD-623905) CFSTI: HC $2.00/MF $0.50

Progress is reported on a program to improve the characteristics of parylene coated foil capacitor and to develop a metallized parylene capacitor capable of operating over the temperature range of −55° C to 125° C at a rated voltage of 100 VDC, whose capacitance volume ratio is one-half that of a 50 volt metallized mylar capacitor. Such capacitor to exhibit a dissipation factor less than 0.25%; 250 megaohm microfarad minimum insulation resistance at 125° C; temperature coefficient less than 300 PPM/° C/200% dielectric voltage withstand; less than 5% change in capacitance after life. Topics include: parylene coated foil capacitors (improved cleanliness and smoothness of substrate foil, effects of core material and configuration, case insulation); parylene coated metallized capacitors (design considerations, capacitor web development). TAB

N66-15102*# CBS Labs., Stamford, Conn.
1-1/2 INCH RUGGED IMAGE DISSECTOR TUBE Final Report, 25 Feb.–18 Sep. 1964
S. Juchnowycz 12 Oct. 1964 43 p Prepared for JPL
(Contracts NAS7-100; JPL-950848)
(NASA-CR-68155) CFSTI: HC $2.00/MF $0.50 CSCL 09A

Snubbers, designed to keep the movement of the electron multiplier assembly to a minimum during environmental exposure, were added to the electron multiplier assembly. All cylindrically mounted and welded components were provided with formed tabs to eliminate stress and improve weld quality between components. Tooling was designed and made for the precision manufacture of the image section components. Besides improved ruggedness, the parts were intended to result in greater uniformity of electron optical performance. Critical assembly techniques using the latest welding methods were established. These and other structural modifications resulted in a rugged image dissector tube with improved electronic characteristics and which can withstand environmental stresses in excess of the Mariner C Mars flight qualification test. R.N.A.

N66-15162# Rome Univ. (Italy). Inst. of Electronics.
RECTANGULAR GUIDES LOADED WITH MAGNETIZED FERRITE AND THE SO-CALLED THERMODYNAMIC PARADOX Interim Scientific Report No. 2
Giorgio Barzilai and Giorgio Gerosa 28 Jul. 1965 15 p refs Presented at the Intern. Conf. on the Microwave Behavior of Ferromagnetics and Plasmas, London, 13–17 Sep. 1965
(Contract AF 61(052)-807)
(AFCRL-65-781; AD-623670) CFSTI: HC $1.00/MF $0.50

The so-called thermodynamic paradox associated with a ferrite loaded rectangular waveguide is discussed. It is shown that various structures introduced by some authors to resolve the paradox are, even in the limit case, different structures from the original one leading to the paradox and therefore they do not help in the resolution of the apparent inconsistency. Some experiments have been carried out in order to explain how in a physical structure the power is actually dissipated. Author (TAB)

N66-15165# Clevite Corp., Bedford, Ohio. Piezoelectric Div.
PRODUCTION ENGINEERING MEASURE FOR CERAMIC FILTERS Tenth Quarterly Report, 30 Jun.–29 Sep. 1965
A. Lungo [1965] 17 p
(Contract DA-36-039-AMC-01471(E))
(Rept.-10; AD-623978) CFSTI: HC $1.00/MF $0.50

During this period effort was directed toward establishing a pre-pilot production run of ceramic resonators. Difficulties encountered in the use of the production electroding, poling, and tumble tuning fixtures are presented and discussed. Also, modifications to the production fixtures are listed. Author (TAB)

N66-15173# Boeing Co., Seattle, Wash. Aero-Space Div.
COMPARISON AND EVALUATION OF THREE AUTOMATED CIRCUIT ANALYSIS PROGRAMS: PREDICT, NET-1, AND CIRCUS
R. H. Dickhaut May 1965 17 p
(AD-623963) CFSTI: HC $1.00/MF $0.50

All three programs appear to have outstanding capabilities for a certain type of work. PREDICT is impressive for its flexibility in handling arbitrary mathematical expressions, and thus is ready-made for experimental work with new and different device models, or for modifications of ones already known. The properties of such models can, therefore, be easily determined and studied. NET-1 shows its advantage in the area of production circuit analysis and design. The circuit designer is provided with, upon request, a power supply failure analysis which alerts the designer as to whether supply failure may jeopardize the transistors and diodes in the circuit. CIRCUS has capabilities uniquely fitted to production radiation effects work. TAB

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N66-14346 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ANGER PULSE GENERATOR

J. Piotrkowski *In its* Papers of the Inst. of the Telecommunications Ind. 25 Jun. 1965 p 36–73 refs (See N66-14344 05-07)

The present work contains a theoretical analysis, supported by experimental investigation, of the linear Anger pulse generator, whose principle of operation is described in the monograph of G. H. Glasoe and J. V. Lebacqz entitled "Pulse Generators," which was published in 1948. The results of the investigation have shown that, following the introduction of stabilizing circuits proposed in this article to permit full utilization of the advantages of the Anger over conventional systems, the Anger pulse generator is eminently suitable for radar installations. The main advantage of the Anger circuit is the twofold diminution of the voltage to ground in its elements by comparison with conventional circuits. This advantage is of great value, particularly for high-power installations. Author

N66-14366# Joint Publications Research Service, Washington, D. C.

SIMULATION OF INFORMATION PROCESSING IN A NEURON

I. A. Lyubinskiy and N. V. Pozin 21 Dec. 1965 14 p refs Transl. into ENGLISH from Avtomat. i Telemekh. (Moscow), v. 26, no. 10, Oct. 1964 p 1746–1756

(JPRS-33440; TT-65-34014) CFSTI: $1.00

The functional relation between neuron output and input signals is determined. To make this determination, neuron pulse generation is simulated along with the conditioning process for generation with dendrite interaction. An equation is derived for the generation, the conditions for rhythm transformation by a neuron are established, and the dependence of output frequency on depolarization current is calculated. The physical model of the generating unit is based on a blocking oscillator circuit. Author

N66-14378*# National Aeronautics and Space Administration, Washington, D. C.

PARAMETERS AND CHARACTERISTICS OF ELEMENTS OF AUTOMATION

Dec. 1965 44 p Transl. into ENGLISH of the publ. "Parametry i Kharakteristiki Elementov Avtomatiki" Moscow, Mezhdunarodnaya Federatsiya po Aytomaticheskomu Upr. (IFAK), Nauchno-tekhn. Kom. po Komponentam, 1965

(NASA-TT-F-9807) CFSTI: HC $2.00/MF $0.50 CSCL 09C

A system of characteristics and parameters is proposed for evaluating the elements of automation. Included are discussions on the static parameters and characteristics, dynamic properties and characteristics, error, information characteristics, and reliability of elements associated with an analog converter; and static parameters and characteristics, dynamic characteristics, and reliability of switching elements. R.N.A.

N66-14423# Battelle Memorial Inst., Columbus, Ohio.

A STUDY OF IMPLICATIONS OF REDUCED DEFENSE DEMAND FOR THE ELECTRONICS INDUSTRY Final Report

Charles S. Peet, Peter Max, and Richard J. Bengston 28 Jul. 1965 252 p refs

(AD-471410)

The objective of the research is to examine the implications of reduced defense demand for the electronics industry and to recommend plans and courses of action to minimize adverse implications. As a base for this, it is necessary to define and characterize the industry, and estimate its future course. The electronics industry is the subject of the report. The major tasks were to: (1) define, describe, and measure the electronics industry through 1970; (2) develop assumptions of reductions in defense demand and analyze the resulting implications; (3) develop a planning guide for easing adverse implications. Author (TAB)

N66-14428# New York Univ., N. Y. Lab. for Electroscience Research.

SYNTHESIS AND DESIGN OF A CLASS OF MINIMUM SENSITIVITY ACTIVE NETWORKS FOR MICROELECTRONICS Nineteenth Scientific Report

John J. Golembeski Aug. 1965 76 p refs *Its* Tech. Rept-400-116

(Contract AF 19(628)-379)

(AFCRL-65-578; AD-622713) CFSTI: HC $3.00/MF $0.75

An amplifier configuration is presented which has particular advantages for microcircuit realization. The arrangement described is capable of yielding a fractional gain change which is equal to the product of the fractional deviations in the gains of each of the redundant signal channels. The nominal input–output transmission is maintained, even with complete failure of one or more (but not all) of the signal channels, at the expense of an increase in sensitivity. This sensitivity to large parameter changes can be minimized over an appreciable portion of the amplifier passband by the use of a systematic design procedure which is included. Author (TAB)

N66-14476 Joint Publications Research Service, Washington, D. C.

RESEARCH IN CYBERNETICS

9 Dec. 1965 52 p refs Transl. into ENGLISH from Avtomatyka (Kiev), no. 3, 1965 p 40–84

(JPRS-33253; TT-65-33828) CFSTI: $3.00

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3. THE USE OF RECOGNITION SYSTEMS AS LEARNING CORRECTORS OF EXTREME CONTROL O. G. Ivakhnenko p 17–36 refs (See N66-14479 05-10)

4. A METHOD OF ALGEBRAIC DESCRIPTION OF CONTACTLESS CIRCUITS R. P. Morozov and B. A. Kuznetsov p 37–43 refs (See N66-14480 05-10)

5. ON THE HISTORY OF THE ORIGIN OF EXTREME CONTROL SYSTEMS A. M. Bonch-Bruyevich and M. T. Milokhin p 44–50 refs (See N66-14481 05-10)

N66-14477 Joint Publications Research Service, Washingington, D. C.

SYNTHESIS OF RELIABLE SYSTEMS FROM UNRELIABLE ELEMENTS BY THE FEEDBACK METHOD

V. B. Georgiyevskiy *In its* Res. in Cybernetics 9 Dec. 1965 p 1–7 refs (See N66-14476 05-10) CFSTI: $3.00

This article studies the synthesis of reliable systems by feedback methods with error indication by time doubling—the introduction merely of time redundancy. Because the method of synthesis with different methods of error indication requires the insertion of structure and time, the concept of generalized redundancy for the detection and correction of malfunctions is utilized for the total characterization. Different methods of synthesis and error indication are compared for economy by the use of generalized redundancy. An expression is obtained which theoretically demonstrates the minimum necessary redundancy by using feedback methods. Either individual elements of a system or whole groups may be covered by feedback. The effect of the number of feedback connections in the

system on its reliability and redundancy is explained. The results obtained are a generalization of the known results of element-by-element and unit duplication. Author

N66-14479 Joint Publications Research Service, Washington, D. C.

THE USE OF RECOGNITION SYSTEMS AS LEARNING CORRECTORS OF EXTREME CONTROL

O. G. Ivakhnenko *In its* Res. in Cybernetics 9 Dec. 1965 p 17–36 refs (See N66-14476 05-10) CFSTI: $3.00

This article deals with non-search systems of extreme control which do not use trial steps to change the control effects on the object. Underlying the basic propositions in the given problem are the methods of passive experimentation employed with further use of correlation or regression analysis. Among the numerous difficulties encountered may be indicated the very great volume and time taken to solve the equations on digital computers. Thus, the problem of algorithmizing the problem of column fractionation reduces to a system with twenty equations with twenty variables. The duration of equation solution and the need to take long periods to average the input data results in low control speed. Demands on the correlation (regression) control may be reduced if it is used only as a corrector for high-speed uncoupling of the part of the control system which realized as commutating matrix of switches. The idea suggests itself that "active" or "passive" experimental methods be used only to teach a system of recognition which does not require the solution of equations. By using certain "criteria" the system, after it has been taught, should recognize "situations" and thus give correct indications to correct the characteristics of the uncoupled section. Moreover definitions are given of the concepts of state (or representation) and situation (or image), the circuit is synthesized, and the most useful (informative) criteria for the recognition system—the corrector—are selected. Author

N66-14480 Joint Publications Research Service, Washington, D. C.

A METHOD OF ALGEBRAIC DESCRIPTION OF CONTACTLESS CIRCUITS

R. P. Morozov and B. A. Kuznetsov *In its* Res. in Cybernetics 9 Dec. 1965 p 37–43 refs (See N66-14476 05-10) CFSTI: $3.00

The basic problems inherent in contactless circuit construction are examined, and the necessity for minimizing the number of logic elements is emphasized. To obtain algebraic formulas corresponding to the particular structure of contactless circuits, it is pointed out that algebras must be developed which are specific for each complete set used. The equations of such algebras are called structural formulas of contactless control circuits, and the conversion of these formulas into the minimum number of logic elements consists in representing them with a minimum number of operator signs. The structure of the algebra for performing this operation is described. Rules are formulated for writing Boolean functions into structural formulas of NOR algebra, and it is concluded that any Boolean function may be represented by a structural formula of the third order. This formula may be equated to the ideal conjunctive form of notation in Boolean algebra, and equations are given for converting the expressions of one algebra into another. The concept of the canonical structural formula of the fourth order is introduced, which corresponds to the ideal disjunctive normal form of notation in Boolean algebra. Examples of the method are given. M.G.J.

N66-14481 Joint Publications Research Service, Washington, D. C.

ON THE HISTORY OF THE ORIGIN OF EXTREME CONTROL SYSTEMS

A. M. Bonch-Bruyevich and M. T. Milokhin *In its* Res. in Cybernetics 4 Dec. 1965 p 44–50 refs (See N66-14476 05-10) CFSTI: $3.00

The origin of closed extreme control systems with feedback is reviewed, in order to acquaint specialists in cybernetic engineering with the technology of earlier systems. Details are given on a regulator designed for extreme tuning of a resonant circuit in a system powering an electric locomotive; published data on the device appeared in 1922. A schematic is shown, and the opinion stated that the device contains the main elements of contemporary extreme regulators with a modulating effect. In 1931, information was published indicating the possibility of extreme regulation of thermal processes in the firing chambers of steam boilers. This regulator, designed to continuously maintain minimum loss in the steam pipe regardless of the load or fuel composition, is described. Details are also given on Soviet developments of extreme step regulators (1940). It is pointed out that by mid-1940 many methods were known for maintaining extreme operating conditions, such as controls with test signal modulation, with step test signal, and with extremum storage. A bibliography is included. M.G.J.

N66-14523# New York Univ., N. Y. Lab. for Electroscience Research.

A NEW CLASS OF FILTERS FOR PULSE APPLICATIONS Scientific Report No. 20

Mohammed S. Ghausi and Michael Adamowicz Sep. 1965 38 p refs *Its* Tech. Rept.-400-117

(Contract AF 19(628)-379; Grant NSF GE-6272)

(AFCRL-65-718; AD-623586) CFSTI: HC $2.00/MF $0.50

The steady-state and transient response characteristics of a new class of low-pass filters are investigated. The natural frequencies of the proposed filters all lie on catenary contours and the transmission zeros are all at infinity. This class of filters has some favorable transmission properties when both time and frequency domain considerations are important. The response characteristics of this class of filters are compared with those of Butterworth, Thomson and the recent one due to Mullick. It is shown that this class has some advantages when rise-time, overshoot, and 3db frequency of the magnitude response (with no frequency peaking) are all of importance. Author (TAB)

N66-14675# Joint Publications Research Service, Washington, D. C.

METHOD OF ANALYSIS IN THE THEORY OF DYNAMIC PROGRAMMING

I. M. Burshteyn 14 Dec. 1965 17 p refs Transl. into ENGLISH from Ekon. i Mat. Metody (USSR), v. 1, no. 5, 1965 p 739–745

(JPRS-33319; TT-65-33894) CFSTI: $1.00

In studying a concrete economic problem, an analysis method is presented relative to the feasibility of using the theory of dynamic programming. The development of representing multistep processes is given by structural diagrams, and the reorganization of these into optimally controllable diagrams. These are then reduced, following the rules of equivalent transformations, to a form which corresponds to the most rational computational process or the most effective analytical apparatus. C.T.C.

N66-14695# Joint Publications Research Service, Washington, D. C.
SUMMARIES OF REPORTS READ AT THE THIRD ALL-UNION CONFERENCE ON AUTOMATIC CONTROL (TECHNICAL CYBERNETICS), ODESSA 1965
13 Dec. 1965 185 p Transl. into ENGLISH of the publ. "Tezisy Dokladov, Tret'ye Vsesoyuznoye Soveshchaniye" Moscow, Natl. Comm. USSR on Autom. Control, 1965 p 2–112
(JPRS-33290; TT-65-33865) CFSTI: $5.00

Summaries are given for a variety of reports dealing with automatic control and cybernetics which were presented at a Soviet conference. Among the systems considered are those which are multiconnected and invariant, nonlinear, discrete, self-tuning, and optimal. Statistical methods are discussed along with recognition of forms, new elements, and characteristics of control objects. Computer usage for production control, automation of production processes, and mathematical modeling methods are the subjects of reviews. Reliability of automatic control devices and systems is considered.
M.W.R.

N66-14735# Michigan Univ., Ann Arbor. Radiation Lab.
LOW FREQUENCY SOLUTION OF THREE-DIMENSIONAL SCATTERING PROBLEMS Scientific Report No. 2
R. E. Kleinman Aug. 1965 59 p refs *Its* Rept.-7133-4-T
(Contract AF 19(628)-4328)
(AFCRL-65-639; AD-623852) CFSTI: HC $3.00/MF $0.75

A deficiency is pointed out in Stevenson's method of reducing the solution of electromagnetic scattering problems to a succession of standard potential problems whose solutions determine terms in the low frequency expansion of the scattered field. An alternate approach is presented, for perfectly conducting scatterers, which not only removes the difficulty but also is simpler and more explicit than Stevenson's method. The details of the analogous, though simpler, scalar scattering problems are also presented. Author (TAB)

N66-14743# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROPERTIES OF CERTAIN STRUCTURES OF MULTIVARIABLE SYSTEMS WITH CONTROLLING MODELS
K. D. Zhuk 17 Sep. 1965 21 p refs Transl. into ENGLISH from Avtomatyka (Kiev), no. 4, 1964 p 3–9
(FTD-TT-65-875/1+2+4; AD-622458) CFSTI: HC $1.00/MF $0.50

Problems of the synthesis of automatic multivariable systems (AMS) are considered on the basis of the conditions of autonomy and invariance. Using elements of the method of inverse operators, the AMS structures previously considered are analysed, and it is shown that the property of complete autonomy in control may be attained by a simple modelling of the links of the multivariable member without unlimitedly large coefficients of amplification or differentiating devices. A simple mathematical proof of this conclusion is given, and corroborated experimentally. In addition, it is shown that it is possible in some cases to construct invariant AMS without directly measuring all of some external perturbations, but using a reversible model of the member in the AMS. Author (TAB)

N66-14819# Reza (F. M.), Syracuse, N. Y.
ON THE PROBABILISTIC CIRCUIT THEORY, II
F. M. Reza Griffiss AFB, N. Y., RADC, Sep. 1965 85 p refs
(Contract AF 30(602)-3252)
(RADC-TR-65-134; AD-622829) CFSTI: HC $3.00/MF $0.75

A probabilistic circuit is an electrical circuit where the element values in the circuit are not fixed, but are defined by some probability functions. The existing literature deals almost solely with the case of gaussian signal and noise. In the case of a probabilistic system the central problem is a characterization of overall system functions in terms of component probability distributions. The present research reported in Part II revolves around this theme, suggesting the successive approximation of log-normal and normal probability distributions. An additive communication channel in the presence of independent noise is perhaps the most widely simulated model of communication. In the present work, emphasis is placed on signals which are nearly normal in contrast with strictly normal signals used in literature. The novel problem presented in this research is the possibility of finding new upper limits for the transmission of information in the presence of a certain type of nongaussian noise. Part III of this report contains the main results of our research in this area. Part IV contains the necessary background of probability theory. Author (TAB)

N66-14842# Wisconsin Univ., Madison. Mathematics Research Center.
THEORY OF OPTIMUM DISCRETE TIME SERIES
H. Halkin, B. W. Jordan, E. Polak, and J. B. Rosen Sep. 1965 31 p refs
(Contract DA-11-022-ORD-2059)
(MRC-601; AD-623751) CFSTI: HC $2.00/MF $0.50

Discrete time systems whose dynamics are represented by recursion relations in the form of finite difference equations are considered. In addition, the control vectors and state vectors may be subject to inequality constraints. The control vectors are to be determined so as to satisfy the constraints and obtain an optimum value for a given function of the control and state vectors. This report gives a maximum principle for this type of discrete problem, and shows its relationship to the Kuhn-Tucker conditions for a finite-dimensional optimization problem. Author (TAB)

N66-14860# Northeastern Univ., Boston, Mass.
PROPERTIES AND APPLICATIONS OF AUTOCORRELATION–INVARIANT FUNCTIONS Scientific Report No. 2
Robert A. Gonsalves Jun. 1965 178 p refs
(Contract AF 19(628)-3312)
(AFCRL-65-427; AD-624158) CFSTI: HC $5.00/MF $1.00

Properties and applications of autocorrelation invariant functions of interest to the communications engineer in the general area of signal design are presented. TAB

N66-14875# California Univ., Berkeley. Electronics Research Lab.
A GENERAL MATCHING THEORY AND APPLICATION TO TUNNEL DIODE AMPLIFIERS
Y. T. Chan and E. S. Kuh 2 Aug. 1965 59 p refs
(Grant AF-AFOSR-139-65; NSF GP-2684)
(Rept.-65-23; AD-474217)

In this paper Youla's theory of broadband matching to include both passive and active 1-port load impedances is generalized. The design philosophy of lossless coupling networks for an active load is different from that of a passive load; however, the design theory is quite similar. The theory is illustrated in a detailed example with a tunnel diode as the active load. Both series resistance and inductance are used in the equivalent circuit representation. New results in terms of theoretical limitation on gain-bandwidth and a sufficient condition for potential stability are obtained. Author (TAB)

N66-14976# Joint Publications Research Service, Washington, D. C.
NEWS OF THE ACADEMY OF SCIENCES USSR, DEPARTMENT OF TECHNICAL SCIENCES, TECHNICAL CYBERNETICS

27 Dec. 1965 258 p refs Transl. into ENGLISH of Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Tekhn. Kibernetika (Moscow), no. 5, Sep.–Oct. 1965 p 1–168
(JPRS-33482; TT-65-34056) CFSTI: $6.00

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7. A PROBABILITY ANALYSIS OF FINITE AUTOMATA AND THEIR RELIABILITY V. I. Levin p 89–102 refs (See N66-14982 05-10)

8. ON A PATTERN RECOGNITION ALGORITHM A. G. Frantsuz p 103–116 refs (See N66-14983 05-08)

9. CALCULATION OF THE PROPERTIES OF RECOGNITION SYMBOLS Yu. L. Barabash p 117–127 refs (See N66-14984 05-08)

10. ANALYTICAL PROCEDURES FOR CALCULATION OF PROCESSES AND LINEAR SEQUENTIAL MACHINES R. G. Faradzhev p 128–141 refs (See N66-14985 05-10)

11. ON A PROCEDURE FOR ECONOMIC ENCODING OF THE STATE OF A PARTIAL AUTOMATION L. K. Larin and L. M. Osinskiy p 142–150 refs (See N66-14986 05-11)

12. THE USE OF DIGITAL COMPUTERS IN A NETWORK PLANNING AND CONTROL SYSTEM S. A. Tarasov p 151–159 refs (See N66-14987 05-10)

13. STATISTICAL SIMULATION OF A PULSE SYSTEM FOR CONTACTLESS MEASUREMENT OF ROLLING RATES V. G. Kotova and Z. I. Sharagina p 160–175 refs (See N66-14988 05-10)

14. THE CONSTRUCTION OF A CONTROL REGION FOR LINEAR NON-STATIONARY SYSTEM N. T. Bang p 176–184 refs (See N66-14989 05-10)

15. CONSTRUCTION OF A CONTROL REGION FOR A SYSTEM WITH AN UNSTABLE OBJECT A. M. Formal'skiy p 185–196 refs (See N66-14990 05-10)

16. ON OPTIMIZATION OF A CONTINUOUS PRODUCTION PROCESS DESCRIBED BY SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS Yu. M. Volin and G. M. Ostrovskiy p 197–204 refs (See N66-14991 05-23)

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18. ON EVALUATION OF THE TIME OF THE TRANSITION PROCESSES IN AUTOMATIC CONTROL SYSTEMS WITH VARIABLE STRUCTURE R. M. Eydinov p 214–224 refs (See N66-14993 05-10)

19. THE INVESTIGATION OF THE DYNAMICS OF MULTISTABLE ELEMENTS ON THE BASIS OF SIMPLIFIED MODEL A. A. Molchanov, V. P. Sigorskiy, and B. M. Fomel' p 225–237 refs (See N66-14994 05-10)

20. ON CONNECTING THE MINSK-1 COMPUTER TO A TELEGRAPH CHANNEL N. G. Zaytsev, V. A. Lebedev, and A. B. Tyukhti p 238–247 (See N66-14995 05-07)

N66-14977 Joint Publications Research Service, Washington, D. C.

APPLICATION OF THE PONTRYAGIN METHOD TO THE INVESTIGATION OF MINIMAL PROBLEMS OF CONTROL PROCESSES

Yu. A. Kochetkov *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 15–30 refs (See N66-14976 05-10) CFSTI: $6.00

This work is devoted to the selection of optimal minimax controls of dynamic systems. In the case where the right hand sides of equations depend in a linear manner on the control functions, a theorem is proved of the existence of an optimal solution. The proof of the necessary Bari condition of existence of a saddle point is presented and some examples investigated. Author

N66-14979 Joint Publications Research Service, Washington, D. C.

INVERSION OF CORRELATION MATRICES AND SOME PROBLEMS IN SELF-ADJUSTMENT

L. M. Kutikov *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 57–64 refs (See N66-14976 05-10) CFSTI: $6.00

A method is proposed for inversion of correlation matrices which leads to simple numerical algorithms. In many important cases the method permits writing of the elements of the inverse matrix in clear form. It may also be useful for the construction of some self-adjustment algorithms. Author

N66-14980 Joint Publications Research Service, Washington, D. C.

SIMULATION OF OPERATIONS ON STOCHASTIC MATRICES

V. M. Boychenko and V. F. Gladkiy *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 65–79 refs (See N66-14976 05-10) CFSTI: $6.00

Methods are investigated for simulation of random automata by relay contact diagrams of elements with controlled reliability. The method is extended to simulation and analysis of various Markov processes and also to simulation of the operations of multiplication and involution of stochastic matrices. Author

N66-14981 Joint Publications Research Service, Washington, D. C.

THE "CAPACITY" OF CONTACT SYSTEMS OF ELEMENT BY ELEMENT RESERVING

N. I. Dudnikov *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 80–88 refs (See N66-14976 05-10) CFSTI: $6.00

A comparative method for evaluating the reliability of contact systems of element by element reserving is investigated based on the use of Markov chain theory for discrete models of the random process of occurrence of breakdowns. The capacity function obtained permits the selection of systems which are optimal with respect to reliability of the system for any ratios of breakdown intensity with respect to zero and one. Author

N66-14982 Joint Publications Research Service, Washington, D. C.

A PROBABILITY ANALYSIS OF FINITE AUTOMATA AND THEIR RELIABILITY

V. I. Levin *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 89–102 refs (See N66-14976 05-10) CFSTI: $6.00

For finite automata with dual elements and a tame structural diagram with respect to probability distributions in time of the inputs, the probability distribution for the states and outputs in any cycle is found. The relationship between the reliability values of the automaton and its elements is defined. Author

N66-14985 Joint Publications Research Service, Washington, D. C.

ANALYTICAL PROCEDURES FOR CALCULATION OF PROCESSES AND LINEAR SEQUENTIAL MACHINES

R. G. Faradzhev *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 128–141 refs (See N66-14976 05-10) CFSTI: $6.00

Expansion formulas for linear sequential machines were calculated, and were found to be similar to known formulas used for the Heviside expansion and in the theory of pulse systems. Examples of the application of results obtained in the determination of processes and zero sequential machines are presented. L.S.

N66-14986 Joint Publications Research Service, Washington, D. C.

ON A PROCEDURE FOR ECONOMIC ENCODING OF THE STATE OF A PARTIAL AUTOMATON

L. K. Larin and L. M. Osinskiy *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 142–150 refs (See N66-14976 05-10) CFSTI: $6.00

The procedure for finding a variant of encoding of the states of a partial automaton is discussed for which the transfer functions of the memory elements depend on the minimum possible number of variables. Author

N66-14987 Joint Publications Research Service, Washington, D. C.

THE USE OF DIGITAL COMPUTERS IN A NETWORK PLANNING AND CONTROL SYSTEM

S. A. Tarasov *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 151–159 refs (See N66-14976 05-10) CFSTI: $6.00

A procedure is presented for encoding network diagrams of operations and condensed notation of them in the operative memory of a computer. The block diagram of the algorithm for calculating the numerical indices is described on the basis of which the construction of a plan and the review of the state of completion of the operations are carried out. With the help of the given algorithm it is possible to plan problems which contain 1000 events and 1500 operations on the average which corresponds to a wide circle of practical problems. The algorithm proposes the use of only the operative memory of a computer. Author

N66-14988 Joint Publications Research Service, Washington, D. C.

STATISTICAL SIMULATION OF A PULSE SYSTEM FOR CONTACTLESS MEASUREMENT OF ROLLING RATES

V. G. Kotova and Z. I. Sharagina *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 160–175 refs (See N66-14976 05-10) CFSTI: $6.00

The use of the method of statistical simulation which permits founding of a base for the principles of construction of a device for pulse measurement of the speed of moving metal and selection of the basic parameters of the device, is investigated. Author

N66-14989 Joint Publications Research Service, Washington, D. C.

THE CONSTRUCTION OF A CONTROL REGION FOR LINEAR NON-STATIONARY SYSTEM

Nguyen Thang Bang *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 176–184 refs (See N66-14976 05-10) CFSTI: $6.00

The problem of determination of the radius of a controlled sphere for linear dynamic systems limited with respect to the controlled effects with fixed time of motion is posed. The necessary condition for optimal control is found which gives the solution to the stated problem. An example is investigated. Author

N66-14990 Joint Publications Research Service, Washington, D. C.

CONSTRUCTION OF A CONTROL REGION FOR A SYSTEM WITH AN UNSTABLE OBJECT

A. M. Formal'skiy *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 185–196 refs (See N66-14976 05-10) CFSTI: $6.00

For an unstable linear system of differential equations the problem is solved of construction in the phase space of the region from each point of which it is possible to arrive at the origin of the co-ordinates using a control which is limited with respect to the modulus. Author

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N66-14992 Joint Publications Research Service, Washington, D. C.

SYNTHESIS OF AN OPTIMAL SYSTEM IN THE PRESENCE OF LIMITATIONS WITH RESPECT TO THE PHASE CO-ORDINATE

V. P. Alekperov and N. V. Faldin *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 205–213 refs (See N66-14976 05-10) CFSTI: $6.00

A procedure is discussed for synthesis of a control system which is optimal with respect to rapid action in the presence of limitations on displacement and the rate of displacement of the steering device. The unchanged part of the investigated system is described by a differential equation with constant coefficients, the characteristic equation of which has only real non-positive roots. As an example, a system of the third order is synthesized. Author

N66-14993 Joint Publications Research Service, Washington, D. C.

ON EVALUATION OF THE TIME OF THE TRANSITION PROCESSES IN AUTOMATIC CONTROL SYSTEMS WITH VARIABLE STRUCTURE

R. M. Eydinov *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 214–224 refs (See N66-14976 05-10) CFSTI: $6.00

The small parameter method is used for obtaining asymptotic expressions which determine the time interval from the time of application of a disturbance to the beginning of the sliding condition. The region of the initial conditions is roughly evaluated for which there is no readjustment in this part of the transition process. Author

N66-14994 Joint Publications Research Service, Washington, D. C.

THE INVESTIGATION OF THE DYNAMICS OF MULTISTABLE ELEMENTS ON THE BASIS OF A SIMPLIFIED MODEL

A. A. Molchanov, V. P. Sigorskiy, and B. M. Fomel' *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 225–237 refs (See N66-14976 05-10) CFSTI: $6.00

The construction and foundation for an idealized model of multistable elements are presented where the model permits sufficiently complete investigation of the dynamics of these elements. The possibilities of the model are demonstrated in an example of two multistable elements—the synchrotron and the spectrotron. Author

N66-15063*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
CIRCAL: ON-LINE ANALYSIS OF ELECTRONIC NETWORKS
Michael L. Dertouzos and Charles W. Therrien Oct. 1965 121 p refs
(Grant NsG-496)
(NASA-CR-68213; ESL-R-248) CFSTI: HC $4.00/MF $1.00 CSCL 09C

A method is presented for the on-line simulation of electrical networks. The program generated from such a method can be used as a powerful design tool in man-machine interaction. The method presently treats networks consisting of linear and nonlinear resistors as well as linear energy storage elements and can be extended to nonlinear energy storage elements. The network is described to the computer either by typing elements and nodes to which they connect or by composing the network with a light pen on a cathode ray tube. Voltage and current sources which may be arbitrary functions of time excite the network, and the voltage across any pair of nodes as a function of time is calculated and may be displayed. The computer model for the network consists of storage-resistor lists representing branches connected to other lists representing nodes. A computer program for use on the compatible time-sharing system was written to implement the foregoing method. Author

N66-15070*# General Dynamics/Convair, Huntsville, Ala.
SIMULATION OF SELECTED DISCRETE NETWORKS. VOLUME THREE: SATURN I-C ENGINE CUTOFF SYSTEM MODEL Final Report
Oct. 1965 51 p
(Contract NAS8-20016)
(NASA-CR-69143; GD/C-DDF-65-005) CFSTI: HC $3.00/MF $0.50 CSCL 09C

A study of the S1-C engine cutoff system is summarized; a Discrete Network Simulator (DNS) model is defined, and it is demonstrated how this model and the computer programs simulate the hardware system. It is shown that the output from the DNS programs can be varied to suit the application, and examples of the different output modes are explained. One application for the DNS model is to analyze how the failure of critical components would affect the system operation. To demonstrate this application, the DNS model was run after programming into it failures of selected components at specified times in the normal operation, and the results of these simulations are condensed and summarized. The DNS programs, combined with a logic model of the hardware system, provide an anlytical tool that can be applied to many different specific applications, and some examples of these possible applications are included. C.T.C.

N66-15107# New York Univ., N. Y. Lab. for Electroscience Research.
ANALYSIS AND DESIGN CONSIDERATIONS FOR DISTRIBUTED RC NETWORKS WITH ARBITRARY TAPER Scientific Report No. 18
John J. Kelly Aug. 1965 153 p refs Its Rept.-400-115
(Contract AF 19(628)-279)
(AFCRL-65-577; AD-623585) CFSTI: HC $4.00/MF $1.00

Analysis and design techniques are considered for arbitrarily tapered distributed RC networks. The RC two-port parameters are shown to be simple functions of the Basic Set solutions of the Sturm Equation. The immittance parameters, when written in Basic Set notation, are treated in the context of classical lumped network theory. They are shown to be positive real functions and their pole-zero characteristics in the s-plane are shown to be closely related to those of lumped RC networks. From the knowledge of the network poles and zeros, root locus is shown to be an efficient method of determining network behavior. The design of RC networks to realize a low-pass and bandpass network function is considered. The low-pass design is accomplished by including a specification of allowable magnitude and phase error in the statement of the desired low-pass function. The RC network is chosen so that the error terms are within the specified bounds. Bandpass response is accomplished using an active element and feedback. Extensive use is made of the root locus to achieve a design which is relatively insensitive to network parameter variations. TAB

N66-15176# Parke Mathematical Labs., Inc., Carlisle, Mass.
SUBSTITUTION ALGEBRAS WITH FEEDBACK Scientific Report No. 1
John A. Riley Aug. 1965 49 p refs
(Contract AF 19(628)-4790)
(AFRCL-65-719; AD-624162) CFSTI: HC $2.00/MF $0.50

The general theory of substitution algebras is extended so as to include devices with time-dependent input/output signals. Abstract notions of delay and feedback are defined, and their basic properties are investigated. Some of the principles of automata theory are given. The discussion is an amalgamation of several sources, and is included here for the purposes of comparison with the theory of substitution algebras with feedback. It is shown that in a certain sense, the two theories are coextensive. Author (TAB)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N66-14352# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY NO. 256 (ACCELERATORS AND DETECTORS)
8 Dec. 1965 53 p Transl. into ENGLISH from Yuan-tzu-neng Ti Yuan-li Ho Ying-Yung (Peiping), Chapter IV, Jul. 1965 p 52-92
(JPRS-33226; TT-65-33801) CFSTI: $3.00

Various kinds and uses of accelerators and detectors are discussed and illustrated. This narrative is concerned with multistage, electrostatic, and linear accelerators as well as the cyclotron, betatron, and synchroton. Neutron production is considered in general terms. Among the detectors mentioned are the cloud, ionization, bubble, scintillation, and spark chambers; proportion, Geiger-Muller, and semiconductor counters; and luminescence screens and scintillation counters. Neutron and X-ray detection are discussed along with high potential sources. M.W.R.

N66-14353# Rensselaer Polytechnic Inst., Troy, N. Y.
LECTURE NOTES ON THE OPERATION OF THE R.P.I. LINAC
R. Fullwood 30 Aug. 1964 108 p Revised

Operation of the R.P.I. Linac, a linear accelerator at the Rensselaer Polytechnic Institute, is described in a series of lecture notes. A block diagram of the accelerator is shown; location

of the console and modulator and accelerator rooms is discussed; and operation and tuning sequences are given. Notes deal with timing sequences, trigger generator and injection delay, the vacuum system, and cooling. Order of protection in the interlock chain is discussed as are the various aspects of the main accelerator interlock. This includes attention to klystron current, temperature, and current; and high voltage power supply, output coupler temperature, and the drift tube. Safety procedures are stressed. M.W.R.

N66-14406 Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

THE ACTIVITIES AND DUTIES OF THE PHYSICS LABORATORY OF THE ISOTITUTO SUPERIORE DI SANITA. [ATTIVITA E COMPITI DEI LABORATORI DI FISICA DELL' INSTITUTO SUPERIORE DI SANITA]

M. Ageno 2 Jul. 1965 38 p In ITALIAN; ENGLISH summary (ISS-65/19) CFSTI: HC $2.00/MF $0.50

The research-work in progress at this laboratory is briefly described, giving evidence of the strict correlations between these activities and the control tests carried out by law in the laboratory. Given at the same time is a brief account of the internal organization of the laboratory and its way of functioning.

Author

N66-14413# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AERODYNAMIC SCALES

A. A. Svyapogorov 7 Oct. 1965 4 p Transl. into ENGLISH from Russian Patent no. 167323 (Appl. no. 837814/26-10, 22 May 1963) 2 p

(FTD-TT-65-1132/1+2+4; AD-623188) CFSTI: HC $1.00/MF $0.50

The aerodynamic scales for investigating nozzle systems, containing chambers with a piston to balance the measured force, are different in that, to accelerate the process of measuring and increase the accuracy of measurements, a tensiometric censer is used in them as a zero indicator. Author (TAB)

N66-14417*# California Univ., Berkeley. Space Sciences Lab.

THE ROLE OF THE RESEARCH ADMINISTRATOR

C. W. Churchman, C. E. Kruytbosch, and P. Ratoosh Oct. 1965 16 p refs *Its* Internal Working Paper No. 38

(Grant NsG-243-62)

(NASA-CR-68969) CFSTI: HC $1.00/MF $0.50 CSCL 05A

This paper reports a preliminary attempt to characterize a number of role orientations among research administrators by means of a series of self-administered rankings of the functions they perform. Mutually exclusive administrative and research orientations appeared in the rankings. The former stressed administrative control and planning functions and de-emphasized involvement in scientific and technical activities, and human relations functions; the researchers reversed these positions. A further managerial orientation stressed planning and human relations functions and placed low value upon research and administrative control. The sample was too small to permit significant correlations between the role orientations and organizational and career variables. A striking feature of the rankings was that respondents who had held their positions for several years were more consistent in the various rankings than were more recent arrivals. This strongly suggests a developmental pattern to the role orientations. Author

N66-14449# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-Sous Bagneux.

THE HYPERSONIC RESEARCH WIND-TUNNELS OF THE O.N.E.R.A. CENTER OF CHALAIS-MEUDON [SOUFFLERIES HYPERSONIQUES DE RECHERCHES DE CHALAIS-MEUDON]

Pierre Rebuffet, Jean-Daniel Vagner, and Jean-Pierre Chevalier Oct. 1965 50 p refs In FRENCH; ENGLISH summary (ONERA-TN-83) CFSTI: HC $3.00/MF $0.50

The Aeronautics Department of O.N.E.R.A. has designed and built at Chalais-Meudon, between 1959 and 1964, a group of blow-down hypersonic wind-tunnels for basic and applied research in the Mach number ranges:

$2 < M < 5$ for wind-tunnel R1Ch
$5 < M < 7$ for wind-tunnel R2Ch
$8 < M < 10$ for wind-tunnel R3Ch.

R1 has a 0.5-ft square test-section and R2 and R3 have a useful diameter of 1 ft. Compressed air stored at 250 atm. supplies these three wind-tunnels and is heated to a temperature appropriate to the desired Mach number. The air-conditioning system, the wind-tunnels, the supporting devices for the models and the instrumentation are described. The results of nozzle probing and of measurement with calibrated models are given.

Author

N66-14553*# Bendix Corp., Ann Arbor, Mich. Systems Div.

SURVEYOR LUNAR ROVING VEHICLE, PHASE I. VOLUME III: PRELIMINARY DESIGN AND SYSTEM DESCRIPTION, BOOK 2: VALIDATION OF PRELIMINARY DESIGN, SECTIONS 7–13 Final Technical Report

Apr. 1964 493 p refs Prepared for JPL

(Contracts NAS7-100; JPL-950656)

(NASA-CR-69102; BSR-903) CFSTI: HC $7.93/MF $2.50 CSCL 22D

In validating the preliminary design of the Surveyor lunar roving vehicle, such data as the system requirements, concepts, functions, performance, and concept trade-offs were considered. Detailed information is presented on systems and subsystems pertaining to navigation, vehicle and control and display, television, telecommunications, primary power supply, and thermal control. Ground facility functional requirements are defined, the preliminary design for a deep space instrumentation facility/space flight operation facility is described, and mission-dependent equipment is discussed. Ground computation requirements and the use of the space flight operation facility computer complex are also considered. Schematics, block diagrams, graphs, and tabulated data amplify the text.

M.G.J.

N66-14578*# RCA Service Co., Inc., Camden, N. J. Nuclear and Scientific Services Dept.

A LARGE ULTRA HIGH VACUUM ENVIRONMENTAL CHAMBER WITH LIQUID HELIUM COOLED WALLS

C. D. Elderkin and J. M. Bradford (NASA, Langley Res. Center) [1965] 21 p Presented at Inst. of Environ. Sci. 1965 Tech. Meeting and Equipment Exposition, 21–23 Apr. 1965

(Contract NAS1-1918(c))

(NASA-CR-69090) CFSTI: HC $1.00/MF $0.50 CSCL 14B

A description is given of a large ultrahigh vacuum environmental chamber for simulating space conditions. In order to duplicate the temperature of the space sink, the test object is surrounded by a cryogenic wall at liquid helium temperatures. These walls are coated with a high absorptance coating to simulate the radiative heat sink of space, and also pump most molecules that strike it. A schematic of the vacuum system is

shown, and is basically triple walled. The outer chamber is a conventional vacuum vessel and the inner chamber is cooled to liquid nitrogen temperatures. The helium panel is inside the inner chamber and is cooled to liquid nitrogen temperatures. The space inside the inner chamber is pumped by four 35 inch diffusion pumps and the annular space between the outer chamber and the inner chamber is pumped by one 20 inch diffusion pump. A helium refrigerator/liquefier supplied the cold helium to the cryowall. C.T.C.

N66-14711*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FEASIBILITY OF ACCELERATING MICRON-SIZE PARTICLES IN SHOCK-TUBE FLOWS FOR HYPERVELOCITY DEGRADATION OF REFLECTIVE SURFACES
Michael J. Mirtich and Herman Mark Washington, NASA, Jan. 1966 38 p refs
(NASA-TN-D-3187) CFSTI: HC $2.00/MF $0.50 CSCL 14B

The feasibility of using short-duration shock-tube flows to accelerate micron-size particles of known mass and composition to hypervelocities has been studied both analytically and experimentally. Analytic studies that use the Stokes drag law corrected for slip flow by the semiempirical Cunningham-Millikan correction factor were made for various shock Mach numbers to 30, and the character of the acceleration problem was outlined. Experimental studies were made by accelerating micron-size particles to Mach 13 in a 2.9-inch shock tube. These studies demonstrated that short-duration shock-tube flows could be used as a means of accelerating micron-size particles for exposing surfaces to hypervelocity impact. Optical properties of these exposed surfaces were quite reproducibly affected by exposure, and an analytical model of the surface degradation phenomenon satisfactorily related measured reduction of surface reflectance with the total energy of impinging particles. The analysis suggested a means of using accurate measurements in the laboratory to predict reflectance degradation for surfaces under actual meteoroid dust exposure in space. Author

N66-14825# Craig Systems, Inc., Lawrence, Mass.
MOBILITY ASPECTS OF A SYSTEM DESIGN FOR A DEPLOYABLE RECONNAISSANCE EXTRACTION FACILITY
Alex J. Reynolds and Stanford T. Hovey Griffiss AFB, N. Y., RADC, Jul. 1965 68 p
(Contract AF 30(602)-3193)
(RADC-TR-65-222; AD-622082) CFSTI: HC $3.00/MF $0.75

This report contains an analysis of factors to be considered in the selection of shelters, power, air conditioning, and transporters relative to efficiency in the attainment of over-all mobility. The evaluations presented herein involved ensuring the best and most timely use of existing technologies. Selection of what was considered to be optimum choices in unit equipments was then integrated to evolve a standard plan for deployment. Author (TAB)

N66-15001*# Public Health Service, Phoenix, Ariz. Technology Branch.
COMPARATIVE LEVELS AND TYPES OF MICROBIAL CONTAMINATION DETECTED IN INDUSTRIAL CLEAN ROOMS Report No. 9
Martin S. Favero, John R. Puleo, James H. Marshall, and Gordon S. Oxborrow 9 Dec. 1965 46 p refs
(NASA Order R-137)
(NASA-CR-69216) CFSTI: HC $2.00/MF $0.50 CSCL 14B

This study was conducted to determine quantitatively and qualitatively the predominant types of microbial contamination in conventional and laminar flow clean rooms. One horizontal laminar flow and three conventional industrial clean rooms and three open factory areas were selected for microbiological tests. Results showed that as environmental and personnel of a clean room were controlled with respect to reducing particulate contamination, microbial contaminants were reduced. Main microbial contamination sources were associated with the density and activity of clean room personnel. Most microorganisms isolated from the intramural air were those indigenous to humans. Studies on fallout and accumulation of airborne microorganisms on stainless steel surfaces showed that although there were no large differences in microbial contamination levels among conventional clean rooms, the type of microorganism detected on stainless steel surfaces was consistently different. The stainless steel strip method for detecting microbial accumulation is efficient and sensitive in ultra-clean environments and is reliable and practical for monitoring microbial contamination in clean rooms for assembling sterilized space hardware. R.N.A.

N66-15064*# Texas A&M Research Foundation, College Station. Activation Analysis Research Lab.
AN INVESTIGATION OF COMPUTER COUPLED AUTOMATIC ACTIVATION ANALYSIS AND REMOTE LUNAR ANALYSIS Quarterly Progress Report, Nov. 1962–1 Feb. 1963
Lloyd E. Fite, Edgar L. Steele, Richard E. Wainerdi, Edward Ibert, and Wayne Wilkins 1 Feb. 1963 74 p refs
(Grant NsG-256-62; Contract AT (40-1)-2671)
(NASA-CR-69215) CFSTI: HC $3.00/MF $0.75 CSCL 14B

The Mark II automatic activation analysis system is described, research in chemistry applications using this system is given, and a feasibility study is made of remote lunar analysis. A detailed description is given, in the form of an addendum, of the logic circuits governing the sequence of steps in the operations of the system. Topics considered are sample selection and the master control unit which is explained by a step-by-step analysis of a typical program cycle. In the chemistry applications area, count-test standard, silver, and selenium analyses were made. The silver analysis consists of studying the influence of radiation on ion migration in mice, and the selenium analysis consists of determining submicrogram quantities by radioactivation utilizing thermal neutrons and gamma ray spectroscopy. In the lunar study, a first generation remote activation analysis system is described, and results from the evaluation of simulated lunar samples are given. These samples were processed in a geometrical configuration similar to that expected on actual lunar exploration. C.T.C.

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N66-14375# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
EFFECT OF MACH NUMBER OF STREAMWISE VORTICES IN LAMINAR REATTACHING FLOWS
Jean J. Ginoux Jul. 1965 35 p refs
(Grant AF-EOAR-65-11)
(VKI-TN-26) CFSTI: HC $2.00/MF $0.50

An experimental investigation has been made in various supersonic and hypersonic wind tunnels to determine the effect of Mach number on the existence of streamwise vortices in the

reattachment region of the flow over two-dimensional backward facing steps. It was found that the phenomenon previously observed at M = 2.21 remained unchanged over a Mach number range of 1.5 to 7.0. The ratio of the wavelength of the vortices to the boundary layer thickness at separation varied slightly with free stream Mach number, with a maximum at about M = 3.
Author

N66-14385*# Iowa State Univ. of Science and Technology, Ames.
THROUGH-FLOW SOLUTION FOR AXIAL-FLOW TURBOMACHINE BLADE ROWS
Patrick Kavanagh and George K. Serovy Washington, NASA, Jan. 1966 94 p refs
(Grant NsG-62)
(NASA-CR-363) CFSTI: HC $3.00/MF $0.75 CSCL 20D

A method of analysis for the blade-to-blade flow through a turbomachine blade row made up of a finite number of blades having finite thickness distributions is presented. The fluid is assumed incompressible and nonviscous. The analysis assumes steady flow relative to the blades along a given stream surface of revolution. At stations far upstream and downstream of the blade row the flow is known and axisymmetric. The blade-to-blade flow equation is formulated in terms of a stream function, resulting in a boundary value problem with associated boundary conditions expressed for the stream function. An iterative numerical solution method based on finite difference approximations and applicable to general blade cascade configurations is developed and programmed for computer solution. Flow patterns and head coefficient distributions for several selected cascade configurations and flow conditions are presented to indicate the validity of the present program and the prospects for further development. An experimental investigation conducted in water on two-dimensional cascades of NACA 65(A_{10})-810 compressor blades is described. Cascade configurations involving three different blade setting angles in combination with minimum-loss incidence and turning angles for a constant blade solidity were tested over a range of Reynolds numbers from about 89 000 to 134 000. Measured profile head distributions are compared with available data from previous cascade investigations conducted in air, and with theoretically computed results.
Author

N66-14390*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
POSSIBLE OCCURRENCE OF BOUNDARY SHOCK WAVES
E. Dale Martin Washington, NASA, Jan. 1966 53 p refs
(NASA-TN-D-3195) CFSTI: HC $3.00/MF $0.50 CSCL 20D

The possible occurrence of a viscous region near a surface from which there is rapid efflux of gas, accompanied by large heat transfer, is postulated and investigated theoretically. Such a viscous region, denoted as a boundary shock wave, may occur in the case of a large high-speed meteor entering the earth's atmosphere. The conditions across a boundary shock wave and its structure are calculated from the appropriate macroscopic equations reduced to closed-form expressions under the restriction of a perfect gas flowing at constant total enthalpy.
Author

N66-14412# Navy Underwater Sound Lab., New London, Conn. Engineering Branch.
VELOCITY MEASUREMENTS IN A VISCOUS FLUID WITH A HOT-WIRE ANEMOMETER
Fred J. Contrata, Jr. (M.S. Thesis—Rhode Island Univ.) 5 Oct. 1965 39 p refs
(USL-699; AD-623278) CFSTI: HC $2.00/MF $0.50

The measurement of small velocities in a highly viscous fluid is impractical if standard static-impact tube methods are employed. Fluid resistance to flow is great and, consequently, measurements with a static-impact system are too time-consuming to be useful. Since a system requiring fluid movement though a constricted passage could not be employed, velocity measurements were made with a hot-wire anemometer. The investigation of the problems involved and the techniques developed in adapting the hot-wire anemometer for these velocity measurements are the subjects of the report. The hot-wire sensing element was successfully calibrated by use of a current difference technique. This calibration curve was used to measure seven velocity profiles, and the resulting profiles are thoroughly discussed. The report includes a discussion of the effects of hot-wire sensing element geometry; end conduction heat loss from the hot-wire sensing element; radial temperature gradient at the test section; and the effect of the hot-wire probe on the measurements under certain conditions. Recommendations are made for the design of an improved hot-wire sensing element positioning device together with a recommended technique for the extensions of the calibration curve.
Author (TAB)

N66-14415# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
THEORY OF BOUNDARY LAYER NOISE Final Report
John E. Ffowcs Williams 13 Jul. 1965 34 p refs
(Contract Nonr-4285(00))
(BBN-1301; AD-622720) CFSTI: HC $2.00/MF $0.50

Contents: Mechanism of noise generation in a turbulent boundary layer; Vibration induced by boundary layer turbulence; Surface-pressure fluctuations induced by boundary-layer flow at finite Mach number; Sound radiation from turbulent boundary layers formed on compliant surfaces; and the influence of simple supports on the radiation from turbulent flow near a plane compliant surface.
TAB

N66-14458# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics.
ON THE FLOW PAST A SEMI-INFINITE FLAT PLATE
Carl Kaplan Jun. 1965 31 p refs
(Contract AF 49(638)-496)
(AFOSR-65-0975; AD-623326) CFSTI: HC $2.00/MF $0.50

The Navier-Stokes equations for two-dimensional flow are linearized around a dominant uniform stream velocity. The concept of field modes in fluid mechanics is then applied to the often-treated and well-known problem of viscous incompressible flow over a semi-infinite flat plate fixed in an unbounded uniform stream. One of the results that emerges from this novel treatment of an old problem is that the usual notion of a displacement thickness leads naturally to a displacement boundary beyond which the streamlines of the viscous flow past the flat plate are indistinguishable from the streamlines due to potential flow past this boundary.
Author (TAB)

N66-14485# France. Ministere de l'Air, Paris.
CONTRIBUTION TO THE STUDY OF LIQUID ATOMIZATION IN MOVING AIR [CONTRIBUTION A L'ETUDE DE LA DESAGREGATION DES JETS LIQUIDES DANS L'AIR EN MOUVEMENT]
Francis Debeauvais and Pierre Vernotte Serv. de Doc. Sci. et Tech. de l'Armement, 1964 92 p refs In FRENCH Its Publ. Sci. et Tech. No. 406 CFSTI: HC $3.00/MF $0.75

Two methods of liquid atomization in air currents were studied: suction, which produces a uniform velocity field, and

expulsion which produces a varying field. Experiments were conducted with water and dibutyle phtalate, and microphotography and high speed cinematography techniques were used in determining the droplet dimensions and their spatial distribution. The duration of the atomization process was calculated as a function of the liquid flow and air current velocities. Surface tension and viscosity effects were determined and were shown to be negligible over a large interval. Theoretical calculations agreed with the quantitative results of the experiments.
Transl. by D.T.

N66-14500# Institut Franco-Allemand de Recherches, St. Louis (France).
MECHANICAL AND THERMAL EFFECTS OF CHEMICAL REACTIONS IN COMPRESSIBLE FLUID FLOW [MECHANISCHE UND THERMISCHE EFFEKTE CHEMISCHER REAKTIONEN IN KOMPRESSIBLER STROMUNG]
F. Wecken 25 Feb. 1963 42 p refs In GERMAN
(ISL-T-2/63)

A concept of mechanical energy equilibrium is developed and applied to the gas dynamics of detonation waves. Various parameters of stationary laminar flows are evaluated and their change to turbulent layers discussed. Differential equations for laminar flows, their dimensions, velocity increases, and stationary phases are formed, and Hugoniot curves for expansive and contractive flow effects in detonation waves are shown.
Transl. by G.G.

N66-14519# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
AN IBM 7090 PROGRAM FOR COMPUTING TWO-DIMENSIONAL AND AXIALLY-SYMMETRIC SUPERSONIC FLOW OF AN IDEAL GAS. SUPPLEMENT I: SUBROUTINES FOR COMPUTING THE SHOCK AND FREE STREAMLINE DIVIDING TWO REGIONS OF NON-UNIFORM SUPERSONIC FLOW
F. Edward Ehlers Aug. 1965 52 p refs *Its* Math. Note No. 422
(DI-82-0462; AD-623298) CFSTI: HC $3.00/MF $0.50

Methods for computing a shock wave and also a free steamline dividing two regions of isoenergetic supersonic flow are explained with computed examples of both two-dimensional and axially-symmetric flows. The subroutines as coded in FORTRAN language for the IBM 7094 are listed and the procedures for their use are described. Author (TAB)

N66-14532# Lockheed Missiles and Space Co., Sunnyvale, Calif.
CAVITATION PHENOMENA IN CENTRIFUGAL AND AXIAL FLOW PUMPS—CHAPTERS III AND VII, SECTIONS 23 AND 24
Ya. Karelin 1964 127 p Transl. into ENGLISH from the book "Kavitatsionnye Yavleniya v Tsentrobezhnykhi Osevykh Nasosakh" Moscow, Gos. Nauchn.-Tekhn. Izd., 1963 CFSTI: HC $4.00/MF $1.00

The effects of hydrodynamic conditions, physical properties, and state of the liquid on the start and development of cavitation are examined. The presence of soluble and insoluble impurities, and the importance they assume, are discussed, along with the prevailing opinion that cavitation centers exist in an arbitrary volume of liquid. Experiments were also conducted to determine the variations in water flow velocity due to pressure applications, and to investigate gas and vapor cavitation due to undissolved gases and air in a liquid. Studies were conducted to assess the effects of geometric dimensions and character of the boundary surfaces, the turbulence, boundary layer, and temperature of the liquid on the cavitation characteristics of a pump. Theoretical comparisons were drawn of viscous liquid cavitation, and experimental results are given. Scaling, based on the law of mechanical similarity of the flow motion of a real liquid, is discussed; equations for satisfying geometric similarity are derived; and the choice of linear scale and pressure head scale are considered. M.G.J.

N66-14536# Pennsylvania State Univ., University Park. Ordnance Research Lab.
BOUNDARY-LAYER INVESTIGATION ON A BODY OF REVOLUTION WITH FINS
N. M. Burstein 15 Sep. 1965 125 p refs
(Contract NOw-65-0123-d)
(TM-504-2461-07; AD-623323) CFSTI: HC $4.00/MF $0.75

The properties of the flow near the trailing edge of a body of revolution with fins were investigated experimentally and compared with predicted values based on existing theories. Experimental work included measurements with a hot-wire anemometer to determine some statistical properties of the randomly fluctuating velocity field. These properties include correlation functions and their related power-spectral densities and steady mean values and root-mean-square values of the velocity fluctuations. Further properties of the flow field were established with a pitot-static tube and a vorticity meter that measured streamwise vorticity arising from the fin-and-body configuration. Measurements were also made for the body with a propeller located at 0.97 percent of the body length from the nose. The results obtained establish that the aft fins are the major cause of the radial and circumferential fluctuation of the mean velocity, which give rise to unsteady forces in the propulsor.
Author (TAB)

N66-14574# General Electric Co., Schenectady, N. Y. Research and Development Center.
INVESTIGATION OF WATER AND STEAM AS THE WORKING FLUIDS IN A FLUID AMPLIFIER SPEED GOVERNOR FOR TURBINE GENERATOR SETS Final Report
[1965] 139 p
(Contract Nonr-4001(00))
(AD-622514) CFSTI: HC $4.00/MF $1.00

The dynamic requirements of a steam-operated actuator for the steam valve can be satisfied with fluid amplifer circuits by the use of high gain feedback circuits. The efficiency compares favorably with electromechanical hydraulic systems. Present 'state-of-the-art' in fluid circuit technology limits the minimum actuator area to approximately 20 sq. in. for a 70 rad/sec. closed-loop bandwidth on the actuator stage. The practical problems associated with the actuator are the primary obstacles to the mechanization of the actuator stage. Author (TAB)

N66-14583# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF UNEQUILIBRIZED DISSOCIATION ON FLOW AROUND BLUNT-NOSED BODIES
Yu. P. Lun'kin and M. P. Shtengel' 30 Sep. 1965 13 p refs Transl. into ENGLISH from Tr. Leningr. Politekhn. Inst. (Leningrad), no. 230, 1964 p 7–12
(FTD-TT-65-649/1+2+4; AD-622452) CFSTI: HC $1.00/MF $0.50

Consideration is given to the effect of unequilibrized association of a diatomic gas on the position of the shock wave and the profile of the gas-dynamic parameters along the zero line of the flow of a blunt-nosed body. Author (TAB)

N66-14613# Boeing Scientific Research Labs., Seattle, Wash.
PROGRESS REVIEW, FLIGHT SCIENCES LABORATORY, FIRST SIX MONTHS, 1964
Aug. 1964 56 p refs

Progress is reported on the program of research in aerodynamics, fluid mechanics, magnetohydrodynamics, combustion, detonation, and fluid physics. Jets impinging on the ground are being investigated with the aim of obtaining mathematical models for describing the flow of a jet under these conditions. Vortex structure was examined in some detail. Recirculation and particle entrainment as encountered by helicopters and V/STOL aircraft flying near the ground have increased the importance of jet impingement, particularly such aspects as wall jets, jet mixing, and the mechanics of jets that are essential in understanding how to obtain high lift using boundary layer control by blowing over the surfaces of an airfoil. Progress was made in understanding the motion of a body, such as a ship on the surface of a fluid in motion, by the treatment of the interaction of the body with the wave field. The program of optimizing aerodynamic shapes to obtain minimum drag was completed. Research in magnetohydrodynamics has been concentrated on both the theoretical and experimental aspects of channel flow, ranging from plasma acceleration to strong interaction experiments as required for magnetic nozzles. E.E.B.

N66-14631*# FluiDyne Engineering Corp., Minneapolis, Minn.
FLOW INITIATION STUDY FOR PROPOSED TUBE WIND TUNNEL. PHASE I: PRELIMINARY EVALUATION OF CANDIDATE SYSTEMS
James L. Grunnet, Donald N. Ramis, George H. Thornberg, Paul B. Hasselquist, and William B. Hamre Oct. 1965 172 p refs
(Contract NAS8-20214)
(NASA-CR-69089) CFSTI: HC $5.00/MF $1.00 CSCL 20D

A study of quick-opening valves and/or diaphragms for flow initiation in the proposed high Reynolds number facility tube tunnel was conducted. During this study, the relative merits and disadvantages of several valve types were analyzed on the basis of a literature survey, hydraulic analogy tests and calculations. As a result of the analysis, two valve subtypes (a 20 sq. ft. gate valve and a 94 sq. ft. multiple butterfly valve) were selected as being most promising and worthy of closer study. Author

N66-14657# Joint Publications Research Service, Washington, D. C.
THE EFFECTS OF CAVITATION ON THE MAGNITUDE OF THE INTERMITTENT FORCES TRANSFERRED TO A SHIP'S HULL BY A SCREW PROPELLER AS IT OPERATES
N. N. Babayev and V. G. Lentyakov 27 Dec. 1965 18 p refs Transl. into English from Sudostroyeniye (Leningrad), no. 5, May 1965 p 26–30
(JPRS-33475; TT-65-34049) CFSTI: $1.00

It is noted that as a screw propeller operates, cavitation may originate on its blades as they pass through the zone of retarded flow; a consequence of which is a corresponding lightening of the load on the blades causing vibration of the hull. Relative to this, an attempt is made to calculate the effect of this phenomenon on the magnitude of pulsating pressures which are transmitted by the propeller to the ship's hull. An approximate theoretical method is used, and results are compared with measured data. C.T.C.

N66-14659# Joint Publications Research Service, Washington, D. C.
APPROXIMATE DETERMINATION OF THE PITCH OF A SCREW PROPELLER
B. G. Grigor'yev 27 Dec. 1965 12 p Transl. into ENGLISH from Sudostroyeniye (Leningrad), no. 8, Aug. 1959 p 51–52
(JPRS-33472; TT-65-34046) CFSTI: $1.00

Performance of the pitch of a screw propeller is determined by direct measurements using meter-stock, rule, plumb bob, and also by means of rack and pinion or pendulum pitch geges. Approximation methods are applied for determination of the pitch of a screw propeller, requiring less expenditure of time, and the accuracy of these methods satisfies the requirements imposed. It was concluded that when the operator is accustomed to the procedures, they may be completed without the performance of any measurements, but by means of a visual estimate of the angle $\alpha = 45°$ and the radius R_x. R.W.H.

N66-14722 Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.
LOCAL ISOTROPY IN WIND TUNNEL TURBULENCE
Virgil A. Sandborn and Richard D. Marshall [1965] 29 p refs
(Grant DA-AMC-28-043-64-G9)
(AD-623900) CFSTI: HC $1.00/MF $0.50

Experimental evaluation of the longitudinal turbulent spectrum in the boundary layer of a long test section wind-tunnel is reported. The spectra agree very close with spectra reported for water flow in an ocean tidal channel and also for air flow over the sea surface. The spectra all agree with the predictions of local isotropy. The data reported were taken in a flat plate boundary layer at a station 69 feet from the tunnel entrance. The free-stream velocity was 30 feet per second. These flat plate boundary layer spectra differ greatly from previous data reported for flows with much smaller length dimensions.
Author (TAB)

N66-14729# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
THEORY FOR THE FREE MOLECULE IMPACT PROBE AT AN ARBITRARY ANGLE OF ATTACK
P. C. Hughes May 1965 58 p refs
(Contract AF 19(628)-363)
(UTIAS-103; AD-623868) CFSTI: HC $4.00/MF $1.00

A theoretical analysis was made of the behavior of the free molecule impact pressure probe at an arbitrary angle of attack. The solution is formulated in terms of three parameters which represent the tube geometry, the free stream gas velocity and the tube angle of attack to the flow. A drifting Maxwellian motion of the gas molecules entering the tube and diffuse reflection from the tube wall are assumed. Calculations were made for angles of attack up to 90 degrees, for speed ratios from zero to infinity, and for tube geometries varying from an orifice to an infinitely long tube. Graphs and data are presented at the end of the report. Author (TAB)

N66-14760*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL NOZZLE EXPANSION AND FLOW CHARACTERISTICS OF POTASSIUM VAPOR
Louis J. Goldman and Stanley M. Noser Washington, NASA, Jan. 1966 26 p refs
(NASA-TN-D-3209) CFSTI: HC $1.00/MF $0.50 CSCL 20D

An experimental investigation was undertaken to determine the nozzle expansion and flow characteristics of potassium vapor. The pressure profiles through a convergent-divergent nozzle were measured using an inert-gas-injection technique. The critical weight-flow rates for potassium vapor were determined by use of a volumetric measurement technique.

The nozzle inlet pressure was varied from approximately 6 to 20 pounds per square inch absolute, which corresponds to saturation temperatures of 1240° to 1450° F. Saturated vapor and vapors with up to 250° of indicated superheat were studied. Comparison of the experimental data for saturated inlet conditions with three theoretical expansion processes indicated that a supersaturated-equilibrium chemical species process best represented the data over the range investigation. An expansion index n 1.4 was obtained from the pressure profile data. The critical weight-flow rate data were fit by the equation $W/A_t = 2.135\ p_o$ over the range investigated, where W is the isentropic weight-flow rate, A_t is the nozzle throat area, and p_o is the nozzle inlet pressure. For superheated inlet conditions the expansion index n was found to increase and the critical weight-flow rate to decrease with increasing superheat in accordance with theoretical considerations. Author

N66-14761*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL INVESTIGATION OF STABILITY BOUNDARIES FOR PLANAR AND NONPLANAR SLOSHING IN SPHERICAL TANKS

Irving E. Sumner Washington, NASA., Jan. 1966 20 p refs

(NASA-TN-D-3210) CFSTI: HC $1.00/MF $0.50 CSCL 20D

An experimental investigation was conducted to determine the stability boundaries for both planar and nonplanar motion of the liquid surface in partly filled spherical tanks undergoing lateral sinusoidal oscillations near the fundamental frequency of the liquid oscillations. Tests were conducted over a range of excitation amplitudes for liquid depths from nearly full to nearly empty in tanks with diameters of 0.813, 0.523, and 0.241 meter. The contained slosh liquid was water in all cases. Three distinct types of motion of the liquid surface were observed: stable planar, stable nonplanar, and unstable. The tank excitation frequencies and amplitudes, which define the stability boundaries separating stable and unstable motion, are presented in terms of nondimensional parameters that generalize the effects of tank size for the range investigated. Author

N66-14789# Northrop Corp., Hawthorne, Calif. Norair Div.

A METHOD OF CHARACTERISTICS SOLUTION IN THREE INDEPENDENT VARIABLES Final Technical Documentary Report

B. N. Pridmore Brown and W. J. Franks Wright-Patterson AFB, Ohio, ARL, Jun. 1965 82 p refs

(Contract AF 33(657)-7326)

(ARL-65-124; NOR-65-42; AD-623405) CFSTI: HC $3.00/MF $0.75

An improved method for the solution of hyperbolic partial differential equations in three independent variables is presented, with application to supersonic steady flow of an inviscid ideal gas. A finite difference method of characteristics is used. New approaches which improve accuracy and efficiency in a three dimensional numerical solution are discussed for solving the shock singularities, for controlling finite difference meshes in three dimensional space so that stability conditions are satisfied, and for interpolation. A major departure from previous approaches to this problem is the choice of local coordinates and base point configurations with reference to directions of maximum variation of the dependent variables on the initial value surface. While this condition is automatically satisfied in methods of characteristics solutions in two independent variables it has apparently been ignored in previous approaches to the problem in three variables. It is of sufficient importance to make the difference between meaningless and accurate results. Results illustrating the behavior of the numerical solutions are presented. Author (TAB)

N66-14889# University Coll., Nairobi (Kenya). Dept. of Mechanical Engineering.

AN EXPLICIT THEORETICAL RELATION FOR SKIN FRICTION MEASURED WITH PRESTON OR STANTON TUBE IN TURBULENT FLOW

Rajni P. Patel Jun. 1965 14 p refs

(M-65-1) CFSTI: HC $1.00/MF $0.50

An explicit relation for skin friction measured with Preston or Stanton tube in turbulent flow at moderate Reynolds numbers has been derived. Excellent agreement between the relationship and the measurements of other investigators is demonstrated. Author

N66-14947# California Inst. of Tech., Pasadena. Hydrodynamics Lab.

MEASUREMENTS ON FULLY WETTED AND VENTILATED RING WING HYDROFOILS

A. J. Acosta, E. R. Bate, Jr., and T. Kiceniuk Jun. 1965 40 p refs

(Contract Nonr-220(54))

(E-138.1; AD-623991) CFSTI: HC $2.00/MF $0.50

Force measurements and visual observations were made in a water tunnel on fully wetted and ventilated flows past a family of conical ring wings having a flat plate section geometry. The diameter-chord ratio was varied from one to three, and the total included cone angle was 12 degrees. The fully wetted flows all exhibited separation from the leading edge except for the largest diameter-chord ratio. The effect of ventilation is to reduce markedly the lift curve slope. Pressure distribution measurements were also made under ventilating conditions for one member of this series. The effect of ventilation over only a portion of the circumference of the ring was also briefly investigated. Large cross forces were developed by such ventilation and some comparisons are made between this method of obtaining control forces and more conventional methods. Author (TAB)

N66-15015# Minnesota Univ., Minneapolis. Heat Transfer Lab.

UNIFORM AIR INJECTION INTO A TURBULENT BOUNDARY LAYER FLOW OVER AN AXIAL CIRCULAR CYLINDER

V. K. Jonsson and C. J. Scott Jul. 1965 104 p refs

(Grant AF-AFOSR-17-65)

(HTL-TR-63; AD-621888) CFSTI: HC $3.00/MF $0.75

An experimental study was made of the effects of uniform air injection into the turbulent boundary layer flowing on an axial circular cylinder with a nominal free stream velocity of 120 feet per second. The blowing rate parameter divided by the free stream flow rate varied from 0 to 0.00021 while the Reynolds number based on free stream conditions varied from 400 000 to 1 060 000. The data for velocity profiles were inserted into the momentum equation and the distribution of turbulent shear stress and eddy viscosity was obtained. The correlation of eddy viscosity with both Reynolds number and injection rate was obtained by dividing by the product of the maximum shear stress velocity and boundary layer thickness. Furthermore, the results for the universal velocity profile correlate better when the maximum shear stress velocity is used rather than wall shear stress velocity. When some of the results are compared with previous experiments, the use of the maximum friction factor rather than wall friction factor in the blowing rate parameter produces better correlation between these various experiments. Author (TAB)

N66-15019# David Taylor Model Basin, Washington, D. C. Hydromechanics Lab.

EXPERIMENTAL MEASUREMENTS OF THE STEADY LIFT, DRAG, AND MOMENT ON SURFACE-PIERCING STRUTS

Gene M. Wilburn and H. Smith Haller, Jr. Oct. 1965 53 p refs (DTMB-1778; AD-622631) CFSTI: HC $3.00/MF $0.50

Testing of two surface-piercing strut configurations for the Pitch-Heave Oscillator is described. Experimental measurements were made of the steady lift, drag, and moment on two rectangular planform, finite aspect ratio struts at finite Froude numbers. The first model section had identical symmetrical ogival fairings on the leading and trailing edges and a flat center section. For the second configuration the aft ogive fairing was cut off the first model section, and a square trailing edge was left. The model force and moment coefficients are presented and the wake, spray, and cavitation characteristics of both profiles are discussed. Preliminary computations of the theoretical pressure distributions for 8 two-dimensional sections and computed full-scale forces and moments for the PHO-2 strut configuration are included. Author (TAB)

N66-15025# Joint Publications Research Service, Washington, D. C.

ON THE PROBLEM OF DETERMINING THE MOMENT THAT CAVITATION OF A SCREW PROPELLER SETS IN

S. V. Kulikov 27 Dec. 1965 10 p refs Transl. into ENGLISH from Sudostroyeniye (Leningrad), no. 5, May 1958 p 12–15 (JPRS-33473; TT-65-34047) CFSTI: $1.00

A formula is derived for estimating the moment that cavitation of screw propellers sets in. The formula also makes it possible to estimate the effect of the number of blades, disk ratio, and relative thickness at the moment that cavitation sets in. The formula is generalized from expressions for the connection between the thrust coefficient and the cavitation number. M.R.W.

N66-15106# United Aircraft Corp., East Hartford, Conn. Research Labs.

FLUID AMPLIFICATION. 17: STUDIES OF REATTACHING JET FLOWS IN FLUID-STATE WALL-ATTACHMENT DEVICES

Robert E. Olson and Y. T. Chin Washington, Harry Diamond Labs., 30 Sep. 1965 109 p refs
(Contract DA-49-186-AMC-144(D))
(AD-623911) CFSTI: HC 4.00/MF $0.75

Analytical and experimental studies were conducted to provide information regarding the characteristics of power jet reattachment in wall-attachment digital amplifiers. The experimental studies included investigations of the effect of control flow on the power jet reattachment location for both single- and double-boundary-wall configurations having various wall lengths and the spreading rate of the jet boundary enclosing the separation bubble for single-boundary-wall configurations. These studies were conducted for both subsonic and supersonic jet Mach numbers. The analytical studies included an investigation of techniques for predicting the effect of control flow on the power jet reattachment location for single-boundary wall configurations having a boundary wall of infinite length. An empirical correlation of the experimental results obtained for the infinite length, single-boundary wall configurations is presented from which the effect of control flow on the reattachment location can be estimated. Also presented is a generalization of the effect of terminating the boundary wall. TAB

N66-15181# Rensselaer Polytechnic Inst., Troy, N. Y.

A COMPARATIVE STUDY OF STEADY AND NONSTEADY-FLOW ENERGY SEPARATORS

Joseph S. Hashem (M.S. Thesis) Oct. 1965 70 p refs
(Contract DA-31-124-ARO-D-318)
(TR-AE-6504; AROD-5641-1; AD-624147) CFSTI: HC $3.00/MF $0.75

This paper analyzes and compares two methods of energy separation—a steady-flow method proposed by Ranque over thirty years ago and a non-steady-flow method recently proposed and studied by Foa. Part I of the paper develops a simple theory for devices utilizing the first method (Ranque tubes). Despite its simplicity and extreme idealization, the theory appears to provide better agreement with experimental data than any of the available analytical treatments. Part II is an extension of the Foa theory of the non-steady-flow energy separator. The extension is more idealized than original theory but covers a wider variety of embodiments of the concept. A comparison is also given between the performance characteristics of steady-flow and non-steady-flow energy separators. Part III defines a coefficient of performance for the two devices as refrigerators or air conditioners, and compares these coefficients with those of standard refrigerating cycles.
Author (TAB)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N66-14335# Air Force Cambridge Research Labs., Bedford, Mass. Upper Atmosphere Physics Lab.

ATMOSPHERIC STRUCTURE IN THE LOWER THERMOSPHERE

K. S. W. Champion Aug. 1965 46 p refs
(AFCRL-65-539; AD-622634) CFSTI: HC $2.00/MF $0.50

This review constitutes a revision and updating of the report, Atmospheric Structure and its Variations in the Lower Thermosphere (AD-417 201). It has been prepared for inclusion as an appendix in the proposed new edition of the COSPAR International Reference Atmosphere (CIRA). New density data presented and discussed include the results of four falling-sphere density measurements made at White Sands, New Mexico, and densities deduced from drag effects on Explorer XVII and other satellites. The satellite density data is compared with the predictions of several models of Jacchia and Harris and Priester. Temperature data include revised values deduced by Blamont from Doppler broadening of sodium and potassium resonance lines. The new values are in better agreement with theoretical models than the earlier results. Recent composition results include number densities of O_2, N_2 and O calculated from ultraviolet absorption measurements by Hinteregger, and values of mean molecular mass from Explorer XVII and the rocket measurements of Nier and Schaefer. Author (TAB)

N66-14358# Defence Research Board, Ottawa (Ontario). Directorate of Scientific Information Services.

THE FORMATION OF SHOALEDICE (SAUCER-MOUNDS) AND FENCES

N. V. Glukhova Sep. 1965 6 p Transl. into ENGLISH from Vopr. Arkticheskogo Ledovedeniya, Tr. Arctic and Antarctic Res. Inst. (USSR), v. 267, 1964 p 150–152
(T-440-R) CFSTI: HC $1.00/MF $0.50

Observations are made of a system of shoaled ice mounds, extending from southeast to northwest Russia, which constitutes a natural barrier to the movement of ice from the shallow and more ice-covered part of the sea where the thickest ice is

formed. In spite of differences in shape and size, these ice mounds have common structural features. They are like deep saucers with flat bottoms of layered ice 30 to 40 cm thick. Detritus is contained within the ice and on its surface, which leads to the conclusion that mound formation is due to the outflow of large fragments of hummocks which become stranded in shallow water. A profile through a saucer-shaped ice mount is illustrated. M.W.R.

N66-14361# International Geophysical Year World Data Center A, Washington, D. C. Coordination Office.
AIRGLOW, IONOSPHERE, AURORA, COSMIC RAYS, GEOMAGNETISM, SOLAR ACTIVITY Catalogue of Data, 1 Jul. 1957–30 Jun. 1965
Sep. 1965 121 p

A tabulation is presented for all the aurora, cosmic ray, and geomagnetism data received at the World Data Center in the United States between July 1, 1957 and June 30, 1965; and data on airglow, the ionosphere, and solar activity for the period from January 1, 1960 through June 30, 1965. Observations from all over the world are included. The airglow catalogue lists data from photometric observations for many emission bands; the ionosphere catalogue included vertical incidence soundings as well as measurements of ionospheric electron density, absorption, ionospheric drift, atmospheric radio noise, and whistlers. Instrumental and visual aurora data are given. Cosmic ray data is based on some non-synoptic observations and synoptic observations using neutron and superneutron monitors, an ionization chamber, and cubical meson, narrow angle, or underground telescopes. Geomagnetism data includes data on earth currents and a listing of the contributing observatories. The solar activity catalogue considers Wolf sunspot numbers; solar flares, corona, and magnetic fields; calcium plages; daily maps of the sun; comet tail observations, and other data. M.W.R.

N66-14398# Air Force Cambridge Research Labs., Bedford, Mass. Upper Atmosphere Physics Lab.
MAGNETO-IONIC COUPLING IN AN INHOMOGENEOUS MEDIUM
Yuji Inoue and Samuel Horowitz Sep. 1965 38 p refs *Its* Phys. Sci. Res. Papers No. 138
(AFCRL-65-694; AD-623647) CFSTI: HC $2.00/MF $0.50

The propagation of electromagnetic waves in a horizontally stratified layer of gyrotropic medium is discussed. Derivation of a comprehensive representation for magneto-ionic coupling coefficients allows interpretation of the physical significance of the coupling. Introduction of an invariant quantity for an inhomogeneous medium becomes an important guide for numerical solutions of the wave equation. Numerical results of magneto-ionic coupling coefficients are presented. Based on region properties, characteristic wave types are used; for the anisotropic region, elliptically polarized waves generally are applied. Author (TAB)

N66-14421# Deutscher Wetterdienst, Offenbach am Main (West Germany).
PROJECT CELL STRUCTURE OF THE ATMOSPHERE: SMALL-SCALE WEATHER SITUATIONS, 1 Final Report [KLEINWETTERLAGEN, 1]
Eberhard Müller Jul. 1965 67 p refs
(Contract DA-91-591-EUC-3237)
(AD-471338)

It is intended to establish a connection between the horizontal and temporal distributions of meteorological variables which are included in forecasting, and the vertical distributions which are not included. Theoretically a system of Kleinwetterlagen (KWL) (Small-scale Weather Situations) provides the connecting link; in the practical application this system is represented by a collective of characteristics delineating the horizontal structure of the surface and the 500-mb level, as well as the temporal development. The report defines the objective and methods of approach of the KWL-system by comparing it with similar experiments published in the literature. The guidelines given subsequently are aimed at insuring an objective determination of the characteristics. The 20 characteristics thus defined are of a preliminary character, since the final KWL-system will result only from the statistical investigation of the relationship between the characteristics and the vertical profiles. This will be dealt with in a subsequent report. Author (TAB)

N66-14432# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
ELECTRON DENSITIES IN THE D REGION OF THE IONOSPHERE FROM LOW FREQUENCY SIGNAL STRENGTH MEASUREMENTS IN ROCKETS Scientific Report No. 254
Thomas A. Seliga 1 Nov. 1965 144 p refs
(Contract AF 19(628)-4050)
(AFCRL-65-620; AD-623471) CFSTI: HC $4.00/MF $1.00

Techniques of determining electron densities in the D region of the ionosphere from rocket measurements of field quantities of a CW radio wave transmitted from the ground are described. Iterative methods which are based on a full wave solution of the generalized form of the differential equations governing radio wave propagation in the ionosphere are used to analyze data from two rocket flights at Ft. Churchill, Manitoba, Canada. The results of one flight (July 20, 1963) during a solar eclipse are compared with electron density profiles obtained from an impedance probe flown on the same rocket and from Langmuir probes flown in other rockets about the same time. The data from the second flight (July 26, 1963) was used to qualitatively verify the results of an impedance probe in the same rocket. The methods of analysis have also been applied to data obtained in the nighttime D region by Mechtly (1962), and the electron density profiles obtained by this analysis are presented. Author (TAB)

N66-14446# Aerospace Corp., San Bernardino, Calif. Technology Div.
ON DERIVATIONS AND PROPERTIES OF STOKES' GRAVITY FORMULA
Leendert de Witte May 1965 37 p refs
(Contract AF 04(695)-469)
(TDR-469(S5230-37)-1; BSD-TR-65-463; AD-623654) CFSTI: HC $2.00/MF $0.50

Several independent derivations of Stokes gravity formula were critically analyzed. It is shown that a 'revised' Stokes formula derived by R. A. Hirvonen is not valid for gravity data given on an arbitrary surface as claimed, but only for data given on a sphere as in the original Stokes formula. In derivations based on Poisson's integral theorem a more rigorous treatment of the elimination of zeroth and first order terms of anomalous gravity was presented. The influence of remote zones in the applications of Stokes' formula was evaluated by numerical integration. It is shown that tremendous truncation errors occur unless the integration is extended over the entire globe. The differences in truncation error behavior for different geographical locations are so large that data representing world-wide average behavior may be very misleading when applied to individual locations. The lack of gravity data coverage over very large parts of the globe causes significant errors in geoidal height determinations and vertical extensions of anomalous gravity by Stokes' formula. Author (TAB)

N66-14447# Army Chemical Center, Edgewood, Md.
NEW EFFECTS IN CLOUD PHYSICS
Albert Pfeiffer Sep. 1965 27 p refs
(CRDLR-3312; AD-623003) CFSTI: HC $2.00/MF $0.50

Unique experiments are described showing: (1) an apparently paradoxical behavior in the rising of gas bubbles in smoke and in the subsidence of miniature smoke clouds in a gaseous atmosphere, and (2) the moment of the aerosol particles of a cloud from the gaseous boundary of the cloud into the cloud. It is concluded that: (1) An unexplained force probably attracts the aerosol particles in an aerosol cloud. (2) The observed, apparently paradoxical, behavior of the aerosol cloud is caused by an ordinary, diffusional exchange of gas molecules between the cloud and the adjacent gas. Author (TAB)

N66-14455# Aeronautical Chart and Information Center, St. Louis, Mo. Chart Research Div.
TECTONIC STRUCTURE OF THE ALDAN SHIELD BASEMENT, AS INTERPRETED ON THE BASIS OF LARGE-SCALE AIRBORNE MAGNETIC SURVEY DATA [TEKTONICHESKOM STROYENII FUNDAMENTA ALDANSKOGO SHCHITA V SVETE GEOLOGICHESKOY INTERPRETATSII DANNYKH KRUPNOMASSHTABNOY AEROMAGNITNOY S"YEMKI]
A. I. Krasnov Feb. 1965 20 p refs Transl. into ENGLISH from Soviet. Geol. (USSR), Issue 11, 1964 p 61–71
(TC-882; AD-623421) CFSTI: HC $1.00/MF $0.50

The tectonic structure of the Aldan Shield was determined by means of structural-correlation schemes according to the method of maximum dissectioning of the magnetic field into separate magneto-disturbing objects. According to the interpretation of aeromagnetic data the following can be isolated: anomalous zones of large, medium, and small dimensions; sections of isometric anomalous field; and local anomalies. The Amginskaya, Tyrkandinskaya, Aldan, and Nal'kanskaya anomalous zones are extensive and coincide with abyssal fractures of the foundation. Analysis of aeromagnetic data makes it possible to reach certain conclusions on the nature of manifestation of fracture tectonics in the Aldan Shield formation. The regularities that were detected in the tectonic structure of the Aldan Shield foundation may be used in geologic mapping and prospecting for new deposits of industrial minerals. Details of the structure are given and the significance of the various areas is discussed. E.E.B.

N66-14461# Ludwig-Maximilians-Universität, Munich (West Germany). Meteorologisches Institut.
INVESTIGATION OF THE INFRARED EMISSION SPECTRUM OF THE ATMOSPHERE AND EARTH, PART II Final Report
Hans-Jürgen Bolle 31 Jul. 1965 195 p refs
(Contract AF 61(052)-488)
(AD-623408) CFSTI: HC $5.00/MF $1.00

The emission of the clear sky spectrum has been measured from 7.5 micron to 26 micron at different measuring sites, and under different meteorological conditions. The spectral resolution was approximately 2/cm. From these measurements continuum absorption coefficients have been derived for window regions in the water vapor spectrum. The emission of single lines and groups of lines which could be resolved from adjacent lines has been compared with calculated emissivities based upon theoretical line parameters. From this comparison empirical values of the product line intensity times half width could be deduced. TAB

N66-14498# Defence Research Board, Ottawa (Ontario). Telecommunications Establishment.
ALOUETTE I IONOSPHERIC DATA, ALOSYN, AUGUST 16–AUGUST 31, 1963
[1965] 160 p CFSTI: HC $5.00/MF $1.00

A tabulation of topside sounder synoptic data is given for the Alouette I satellite. The data consists of selected ionospheric parameters obtained from Alouette I ionograms, with the parameters listed in the order in which the ionograms are recorded. Besides the pertinent information for understanding the data, the following parameters are given: angle of dip of earth's magnetic field at the satellite; gyrofrequency at the satellite; ordinary wave frequency at the satellite; observed extraordinary wave frequency at the satellite; accuracy of observation; quality of the reflection trace near the satellite; observed ordinary wave penetration frequency of the F-2 layer; ordinary wave penetration frequency of the F-2 layer; observed extraordinary wave penetration frequency of the F-2 layer; maximum frequency of observation of sporadic E; strength of signal returned from earth; and 3 hourly magnetic Kp index. C.T.C.

N66-14503# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
STRUCTURE OF THE EARTH'S CRUST OF SIBERIA AND THE FAR EAST, ACCORDING TO THE DATA OF REGIONAL GEOPHYSICAL SURVEYS [STROYENIYE ZEMNOY KORY SIBIRI I DAL'NEGO VOSTOKA PO DANNYM REGIONAL'NYKH GEOFIZICHESKIKH ISSLEDOVANIY]
E. E. Fotiadi and G. I. Karatayev Oct. 1964 26 p refs Transl. into ENGLISH from Geol. i Geofiz., Akad. Nauk SSSR, Sibirsk. Otd. (Novosibirsk), no. 10, 1963 p 5–18
(TC-853; AD-623447) CFSTI: HC $1.00/MF $0.50

A variant of a schematic map of the structure of the earth's crust of Siberia and the Far East showing thicknesses of the earth's crust (large forms of Moho discontinuity M) and its subdivision into various structural types and subtypes is discussed. The map is compiled on the basis of adequate interpretation of regional—first of all magnetic—investigation accordingly processed by new methods of the electronic digital computer of the Computation Center of the Siberian Branch of the USSR Academy of Sciences. Subdivision of the territory of Siberia and the Far East according to types and subtypes of the earth's crust is shown for the first time, and a more detailed picture of M discontinuity is given on the map. The map may be used as a basis for considering some problems of deep structure of the earth's crust and also for distinguishing regional anomalies caused by M discontinuity relief in the observed gravity field. Author

N66-14557*# California Univ., La Jolla.
SURFACE CONDITIONS OF THE ORGUEIL METEORITE PARENT BODY AS INDICATED BY MINERAL ASSOCIATIONS
Kurt Bostrom (Scripps Inst. of Oceanog.) and Kurt Fredriksson (Smithsonian Inst.) [1965] 64 p refs
(Grants NsG-317-63; NsG-696; NSF G-12325; NSF B-8089)
(NASA-CR-69097) CFSTI: HC $3.00/MF $0.75 CSCL 08G

A study of the Orgueil meteorite shows that three main periods of mineral formation can be recognized: (1) an early stage with minerals like troilite, that are stable at several hundred degrees centigrade; (2) a middle stage with minerals like chlorite and limonite formed below 170° C; and (3) a late stage with carbonates and sulphates, formed below 50° C. A physicochemical analysis of the mineral-forming conditions indicates that oxidized phases like sulphate and limonite cannot be formed as a result of a local equilibrium but that an oxidizing substance must be brought into the system. Author

N66-14559# Travelers Research Center, Inc., Hartford, Conn.
TECHNIQUES FOR OBJECTIVE HEMISPHERIC ANALYSIS AND PREDICTION OF THE JET STREAM Final Report, 1 Oct. 1964–31 Jul. 1965
David B. Spiegler, John T. Ball, Robert J. Ball, and Bernard J. Erickson Bedford, Mass., AFSC, Electron. Systems Div., Sep. 1965 172 p refs Prepared for United Aircraft Corp., East Hartford, Conn. *Its* Rept.-7463-176)
(Contract AF 19(628)-3437)
(ESD-TR-65-13; AD-622711) CFSTI: HC $5.00/MF $1.00

The objective hemispheric analysis technique incorporates information from data areas into level of maximum wind (LMW) analyses for no-data areas. This is done in a quantitative, objective, and consistent manner by using LMW regression equations that specify the initial-guess fields for the analysis. The analysis technique locates jet cores between grid points, and generates observations along these cores by using horizontal jet profiles. This technique produces high-quality analyses that compare favorably with subjective analyses, and that are generally consistent with one another. The first prediction technique is based on a procedure wherein potential predictors are obtained from a network grid oriented with respect to the LMW wind direction at the prediction point. Prediction equations are obtained by applying the screening regression technique to predictors selected from initial-state LMW parameters (and their 12-hr change) and wind speed values at constant pressure surfaces. Tests on independent data showed that these equations produce prognoses that are better than persistence for all polar and subtropical jet-stream categories. The second prediction technique applies diagnostic LMW regression equations (originally derived to produce the initial-guess fields in the LMW analysis) to constant-pressure-surface numerical prognoses. Author (TAB)

N66-14569# Northwestern Univ., Evanston, Ill. Dept. of Geography.
ENVIRONMENTAL SCIENCES COMPUTER STUDY Final Report
William L. Garrison and William C. Krumbein Aug. 1965 7 p refs
(Contract Nonr-1228(26))
(AD-622833) CFSTI: HC $1.00/MF $0.50

The main goals of the research were, generally: (1) to examine developments in computer hardware and software technology, and to compare these with needs in the earth sciences, (2) conduct certain research and experimental studies toward developing computer 'capability', in those fields. Titles of the 15 technical reports from the study are listed. TAB

N66-14587# California Univ., Los Angeles. Dept. of Meteorology.
INVESTIGATIONS OF THE POLARIZATION OF THE SUN-LIT SKY Scientific Report No. 1
George C. Holzworth and C. R. Nagaraja Rao Feb. 1965 86 p refs
(Contract AF 19(628)-3850)
(AFCRL-65-167; AD-622526) CFSTI: HC $3.00/MF $0.75

Theoretical studies of the features of skylight polarization based on the solution of the radiative transfer problem in a plane-parallel molecular atmosphere are briefly reviewed. The results of a series of systematic measurements of skylight polarization are presented and discussed. The measurements were made at Los Angeles during Spring 1963. A photoelectric skylight polarimeter employing ac light modulation has been employed in these measurements which were confined to three spectral intervals (bandwidth approx. 150A) centered around 4000, 5100 and 6000 A. An attempt has been made to account for the departure of the location and dispersion of the neutral points and the polarization maxima from the computed values for a purely molecular atmosphere in terms of the local turbidity. The effect of the variable reflectivity of the ground on the magnitudes of polarization maxima has been studied. Author (TAB)

N66-14608# Library of Congress, Washington, D. C. Aerospace Technology Div.
THE LOWEST ELECTRON DENSITY NECESSARY FOR WAVE REFLECTION FROM THE IONOSPHERIC D-LAYER Surveys of Soviet Scientific and Technical Literature
G. Nestorov 1 Dec. 1965 11 p refs Transl. into ENGLISH from Compt. Rend. Acad. Bulgare Sci. (Sofia), v. 18, no. 7, 1965 p 631–634
(ATD-65-108)

Proceeding from Alpert's magneto-ionic theory, the formula is derived for complex ionospheric refraction. In the case of long and medium wave propagation in the daytime, the electromagnetic wave is reflected from the middle and upper parts of the D-region. The electron density required for long and medium wave reflection from the D-region can be determined using the necessary transformations. Special cases of wave propagation which can occur in practice are discussed and equations are given for each particular case. E.E.B.

N66-14616# Weapons Research Establishment (Australia).
IONOSPHERIC DATA FOR JANUARY 1965 FROM WOOMERA, SOUTH AUSTRALIA Ionospheric Data Bulletin
Jul. 1965 29 p
(CPD-1965/1(W)) CFSTI: HC $2.00/MF $0.50

Tables of the hourly values of the customary ionospheric parameters are given for the station at Woomera for January 1965. Author

N66-14617# Weapons Research Establishment (Australia).
IONOSPHERIC DATA FOR FEBRUARY 1964 FROM WOOMERA, SOUTH AUSTRALIA Ionospheric Data Bulletin
Aug. 1965 29 p
(CPD-1964/2(W)) CFSTI: HC $2.00/MF $0.50

Tables of the hourly values of the customary ionospheric parameters are given for the station at Woomera for February 1964. Author

N66-14618# Weapons Research Establishment (Australia).
IONOSPHERIC DATA FOR OCTOBER 1964 FROM WOOMERA, SOUTH AUSTRALIA Ionospheric Data Bulletin
Apr. 1965 29 p
(CPD-1964/10(W)) CFSTI: HC $2.00/MF $0.50

Tables of the hourly values of the customary ionospheric parameters are given for the station at Woomera for October 1964. Author

N66-14619# Weapons Research Establishment (Australia).
IONOSPHERIC DATA FOR NOVEMBER 1964 FROM WOOMERA, SOUTH AUSTRALIA Ionospheric Data Bulletin
Jul. 1965 29 p
(CPD-1964/11(W)) CFSTI: HC $2.00/MF $0.50

Tables of the hourly values of the customary ionospheric parameters are given for the station at Woomera for November 1964. Author

N66-14620# Weapons Research Establishment (Australia).
IONOSPHERIC DATA FOR DECEMBER 1964 FROM WOOMERA, SOUTH AUSTRALIA Ionospheric Data Bulletin
Apr. 1965 29 p
(CPD-1964/12(W)) CFSTI: HC $2.00/MF $0.50

Tables of the hourly values of the customary ionospheric parameters are given for the station at Woomera for December 1964. Author

N66-14634*# New York Univ., N. Y. Dept. of Chemistry.
THEORETICAL STUDY OF ATOMIC AND MOLECULAR GASES AND THEIR REACTIONS IN THE UPPER ATMOSPHERE Summary Report, 1 May–31 Oct. 1965
Roop C. Sahni [1965] 15 p refs
(Grant NsG-76-60)
(NASA-CR-69109) CFSTI: HC $1.00/MF $0.50 CSCL 04A

In the previous report it was stated that we have successfully extended the computer programs to include 3s and 3p functions in addition to 1s, 2s and 2p functions to calculate the wave functions and total energies of the different states of diatomic molecules. In addition, it was also mentioned that we have succeeded in varying the screening constants of the basic functions to obtain the best LCAO MO's. This best LCAO MO's work was confined to the equilibrium distance only. The extension of this program to a large number of internuclear distances and to a number of ionized and excited states, in addition to the ground state, involved many problems. We have successfully computed the potential energy curves of different states of N_2 and CO molecules. Some preliminary work has also been done on O_2, NF, CN and NO molecules. Some of these results are given in this report. The above work which aims at obtaining limited Hartree-Fock MO's for different states of diatomic molecules involves immense computation due to the optimization of non-linear parameters (screening constants). Author

N66-14669# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
PROJECT POCIBO Progress Report
John R. Winckler Aug. 1965 129 p Sponsored by NSF
(CR-81)

Problems encountered with balloons, meteorology, and the Arctic environment are described. Particular emphasis was placed on the technical features including the 70 kc long range radio tracking and communications system. Also described in detail is the Pocibo flight gondola including the electronic design of the telemetry and data encoding system, power supply, the thermal properties, and the complement of scientific instruments. The results include observation of atmospheric radiation effects on the balloons documented by auxiliary temperature and radiation measurements, measurements of cosmic ray total ionization, and the studies of the low energy primary cosmic rays, including protons and helium. R.W.H.

N66-14691 Joint Publications Research Service, Washington, D. C.
VERTICAL MOTION OF WATERS IN THE NORTHERN TROPICAL AND EQUATORIAL ZONES OF THE PACIFIC OCEAN
E. R. Belevich 15 Dec. 1965 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 163, no. 6, 21 Aug. 1965 p 1481–1483
(JPRS-33344; TT-65-33919) CFSTI: $1.00

Consideration is given to the intensive vertical circulation which develops from the meeting of powerful water flows at subsurface and intermediate depths in the northern tropical and equatorial zones of the Pacific Ocean. Calculations of vertical velocities, made under the assumption that a geostrophic equilibrium exists in the ocean, were used to draw maps for the winter and summer seasons. Basic zones of tropical convergence and equatorial divergence were noted. Intensive vertical movements in the southern part of the Kuroshio and California currents are associated with irregular distribution in the flows of horizontal velocities. Upwellings and descents of water around the Galapagos, Hawaiian, Caroline, and Mariana Islands are associated with relief at the bottom of the ocean and with the wind. Vertical motions are more intensive in regions and seasons in which the greatest velocities of horizontal currents are noted. Maps showing distribution of vertical velocities agree with data characterizing the biological productivity in the northern tropical and equatorial zones. M.W.R.

N66-14697# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
PROCEDURES FOR GRAPHICAL RECTIFICATION OF TIROS PHOTOGRAPHS
Gene Wooldridge Aug. 1965 34 p refs *Its* Atmospheric Sci. Tech. Paper No. 71
(Contract Cwb-10879; Proj. Wisp)
(Rept.-3)

Graphical rectification procedures for TIROS photographs are reviewed and presented. An example of rectification of a tape mode orbit is performed, and the required steps individually shown. A graphical method is used for making time corrections for the tape mode. Simplified instructions of Fujita's *approximate* method are given and illustrated by drawings. Data sources and requirements, as well as chart requirements are listed. The accuracy necessary for meteorological research is retained while time requirements are considerably less than Fujita's *precise* method. Author

N66-14726# Air Force Cambridge Research Labs., Bedford, Mass. Optical Physics Lab.
SPECTRAL REFLECTANCE AND ALBEDO MEASUREMENTS OF THE EARTH FROM HIGH ALTITUDES
Hans E. Band and Louis C. Block (Utah State Univ.) Sep. 1965 30 p refs *Its* Environ. Res. Papers No. 136
(Contract AF 19(628)-3241; ARPA Order 363; Proj. Defender)
(AFCRL-65-674; AD-623876) CFSTI: HC $2.00/MF $0.50

Spectral radiance measurements over the wavelength range of 0.24 to 0.28 microns were carried out using Ebert-type scanning spectrometers mounted on the aft section of an X-15 aircraft operating up to 270000 altitude. With the assumption of Rayleigh scattering in the atmosphere and allowing for ozone absorption, the reflectance and albedo are estimated and compared with the measured values. The elevations and azimuths of the sun and of the spectrometer during the flight were tabulated and used to compute the scattering and diffuse reflection angles. Apparent reflection of radiation from the ground is estimated, using a Lambert radiator model. Since the spectrometer at times pointed away from the earth, it should be possible to estimate the separate contribution of the ground to the reflectance and total albedo. Author (TAB)

N66-14739# Aeronautical Chart and Information Center, St. Louis, Mo.
DETERMINATION OF THE EARTH'S RADIUS USING PROJECTION METHOD FORMULAS
Vojislav Dimitrijevich Apr. 1964 18 p refs Presented at the 45th Ann. Meeting, Am. Geophys. Union, Washington, D. C. 21–24 Apr. 1964
(AD-622816) CFSTI: HC $1.00/MF $0.50

The paper presents a summary of methods commonly used to determine the earth's size and shape and a brief review of the projection method. To illustrate the projection method, a numerical example is given using 12 astrogeodetic stations on the North American Datum 1927, Clarke 1866 Ellipsoid. In the

example, the flattening for the new ellipsoid is assumed fixed at 1/298.3 as previously determined by Helmert and Krasovskiy. The value of da is determined as −35.1 m and, by computation from Milan Bursa's formulas for determination of 'a' for Europe, the value of da is −35.3 m. Although the number of stations which are used in the example is too small, it is adequate to demonstrate the projection method for obtaining the equatorial radius.
Author (TAB)

N66-14821# Republic Aviation Corp., Farmingdale, N. Y.
DESIGN OF THE PAYLOAD AND EXPERIMENT TO MEASURE THE VECTOR COMPONENTS OF THE EARTH'S MAGNETIC FIELD FROM A JAVELIN ROCKET Final Report, 1 Dec. 1964–31 Aug. 1965
Percy G. Forsyth 30 Sep. 1965 27 p refs
(Contract AF 19(628)-2372)
(FHR-2240-2; AFCRL-65-804; AD-624088) CFSTI: HC $2.00/MF $0.50

This report summarizes the results of feasibility tests to measure the earth's vector magnetic field from a Javelin rocket, and describes briefly the missile and ground electronic systems that have been designed to make the measurement. The program is directed to: Determining the attitude of a Javelin rocket nose cone by means of an electromagnetic attitude sensor using antenna-array signal strength patterns. Making vector component magnetic measurements within the rocket nose cone by means of switched bias coils and a cesium vapor magnetometer. Encoding and telemetering the resulting information in a format compatible with the existing facilities. Developing computational techniques for reducing the data obtained from the above system.
Author (TAB)

N66-14856# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
GEOPHYSICS AND SPACE DATA BULLETIN, VOLUME II, NUMBER 2
Anne L. Carrigan and Norman J. Oliver, ed. 1965 240 p
(AD-624195) CFSTI: HC $6.00/MF $1.25

Contents: Total field intensity magnetometer; cosmic ray neutron intensity monitor; oblique backscatter radar; oblique H-F propagation; riometer, solar optical patrol observations; solar radio emission, and vertical incidence ionospheric soundings.
TAB

N66-14874 Naval Research Lab., Washington, D. C.
IONOSPHERIC COMPOSITION AND DENSITY FROM 90 TO 1200 KILOMETERS AT SOLAR MINIMUM
C. Y. Johnson *In its* Rept. on NRL Progr. Sep. 1965 p 11–14 refs (See N66-14872 05-13)

Relative ion composition measurement from two daytime positive ion mass spectrometer experiments, one at 90 to 240 and the other at 400 to 1200 kilometers, have been normalized to a composite electron density distribution in the altitude range 90 to 1200 kilometers. The result is a number density distribution of the positive ions and electrons in the daytime ionosphere during the 1963–1964 solar minimum. Distributions are shown for ions of hydrogen, helium, atomic and molecular nitrogen, atomic and molecular oxygen, and nitric oxide.
Author

N66-14876# Wisconsin Univ., Madison. Dept. of Meteorology.
STUDIES OF LARGE SCALE ATMOSPHERIC ENERGETICS Annual Report
Jun. 1965 140 p refs
(Grant CWB-WBG-25)

CONTENTS:

1. **ON THE RELATION BETWEEN TIROS RADIATION MEASUREMENTS AND ATMOSPHERIC INFRARED COOLING** W. L. Smith, L. H. Horn, and D. R. Johnson p 1–19 refs (See N66-14877 05-13)
2. **A HARMONIC ANALYSIS OF TIROS IV INFRARED RADIATION MEASUREMENTS** P. J. Smith, L. H. Horn, and D. R. Johnson p 20–29 refs (See N66-14878 05-13)
3. **THE ROLE OF TERRESTRIAL RADIATION IN THE GENERATION OF AVAILABLE POTENTIAL ENERGY** D. R. Johnson p 30–70 refs (See N66-14879 05-13)
4. **TIME STRUCTURE OF ENERGY TRANSFORMATIONS OVER THE NORTHERN HEMISPHERE** A. Carasso, L. H. Horn, and D. R. Johnson p 71–94 refs (See N66-14880 05-13)
5. **THE ROLE OF LATENT AND SENSIBLE HEAT FOR THE DEVELOPMENT OF A HIGH PRESSURE SYSTEM OVER THE SUBTROPICAL ANDES, IN THE SUMMER** G. J. Gutman and W. Schwerdtfeger p 95–124 refs (See N66-14881 05-20)

N66-14877 Wisconsin Univ., Madison. Dept. of Meteorology.
ON THE RELATION BETWEEN TIROS RADIATION MEASUREMENTS AND ATMOSPHERIC INFRARED COOLING
William L. Smith, Lyle H. Horn, and Donald R. Johnson *In its* Studies of Large Scale Atmospheric Energetics Jun. 1965 p 1–19 refs (See N66-14876 05-13)

TIROS II channel 2 and channel 4 measurements of infrared radiation are statistically correlated with corresponding radiometersonde measurements of radiation divergence within various layers of the atmosphere. Estimates of the correlation coefficient greater than 0.60 are obtained for all layers extending from the surface of the earth to levels beyond 600 mb. The results of this study indicate that the satellite measured flux is most significantly related to the infrared cooling profile within the surface-600 mb layer. It is shown that good estimates of the infrared cooling profile might be obtained from satellite measurements if the general sky condition is also known.
Author

N66-14878 Wisconsin Univ., Madison. Dept. of Meteorology.
A HARMONIC ANALYSIS OF TIROS IV INFRARED RADIATION MEASUREMENTS
Phillip J. Smith, Lyle H. Horn, and Donald R. Johnson *In its* Studies of Large Scale Atmospheric Energetics Jun. 1965 p 20–29 refs (See N66-14876 05-13)

The method of harmonic analysis is used to describe the infrared radiation field as measured by the channel 2 radiometer aboard TIROS IV during April, 1962. The analysis, which is done along satellite orbits, includes a partitioning of the resulting spectra into time-averaged and perturbation components. The time-averaged portion of the spectrum clearly describes the mean latitudinal profile of the infrared radiation, while the perturbation portion describes the effect of longitudinal deviations from the mean profile and of transient weather systems. The study reveals that the longitudinally varying and transient features of the infrared radiation field are more significant than is usually thought.
Author

N66-14879 Wisconsin Univ., Madison. Dept. of Meteorology.
THE ROLE OF TERRESTRIAL RADIATION IN THE GENERATION OF AVAILABLE POTENTIAL ENERGY
Donald R. Johnson *In its* Studies of Large Scale Atmospheric Energetics Jun. 1965 p 30–70 refs (See N66-14876 05-13)

The contribution of infrared cooling to the maintenance of thermal atmospheric contrasts was examined. Emphasis was

placed on the role of vertical variations of infrared cooling in the generation of eddy available potential energy, and the design of a diagnostic model with sufficient resolution and reliability to estimate this quantity. Data from radiometersonde flights were used to obtain continuous profiles of temperature and net radiation, and a polynomial technique was applied to integrate the profiles of cooling and temperature. Temperature and heating fields were then utilized to estimate the height variation of the generation of eddy available potential energy within the atmosphere's secondary circulation. This physical model avoids the difficulties involved in a direct study of conversion terms. G.G.

N66-14880 Wisconsin Univ., Madison. Dept. of Meteorology.
TIME STRUCTURE OF ENERGY TRANSFORMATIONS OVER THE NORTHERN HEMISPHERE
Alfred Carasso, Lyle H. Horn, and Donald R. Johnson *In its* Studies of Large Scale Atmospheric Energetics Jun. 1965 p 71–94 refs (See N66-14876 05-13)

Variance and Cross-Spectral techniques are applied to time series of the basic energy parameters defined by Lorenz to investigate the nature of energy transformations as a function of time for periods between 50 days and 4 days, in the 850–500 mb layer north of latitude 20° N. The results suggest a systematic transformation of available potential energy to kinetic energy at periods less than 10 days but fail to reveal any preferred periodicities for longer periods, possibly because of a transfer of energy from outside the region. Author

N66-14886# Miami Univ., Coral Gables, Fla.
THEORY OF DENSIFICATION OF DRY, BUBBLY GLACIER ICE
Henri Bader Hanover, N. H., Army Cold Regions Res. and Eng. Lab., Jul. 1965 24 p refs
(Contract DA-11-190-ENG-91)
(CRREL-RR-141; AD-622192) CFSTI: HC $1.00/MF $0.50

Density and air bubble pressure data obtained from ice cores from Site 2, Greenland, are analyzed to determine porosity at the pore close-off level, which is found to have a very small standard deviation. A theory of densification of bubbly ice is developed on the simple assumption that the rate of decrease in porosity is proportional to porosity and also proportional to the difference between absolute load pressure and air bubble pressure. The theory is remarkable in that it has led to derivation of a useful equation for approximating the value of the integral exp t to the m power (dt) for m > 0. Author (TAB)

N66-14952*# Pittsburgh Univ., Pa. Dept. of Physics.
THE PROBLEM OF ATOMIC HYDROGEN
T. M. Donahue 11 Oct. 1965 51 p refs Symp. on Aeronomy, Cambridge, Mass., Aug. 1965 Submitted for publication
(Contract NASr-179)
(NASA-CR-69211; SRCC-15) CFSTI: HC $3.00/MF $0.50 CSCL 04A

Observations of the Lyman α airglow from 1959 through 1965 indicate that there is a large diurnal variation of hydrogen in the earth's thermosphere and exosphere and that the abundance has changed markedly from solar maximum to solar minimum. The change is always toward more hydrogen with decreasing exospheric temperature as theory predicts. H_α measurements agree with this picture but H_α is an order of magnitude too bright. There is also an extra-terrestrial component in Lyman α. Recent calculations of the effect of lateral flow in the exosphere show that the vertical flux resulting will not wipe out the diurnal hydrogen bulge but will have a serious effect on the helium diurnal variation. Refinement of the escape problem calculations involving abandonment of a discontinuity at the base of the exosphere predict a factor of three reduction in escape rate and a larger solar cycle effect. Author

N66-14960*# Pennsylvania State Univ., University Park. Ionospheric Research Lab.
ELECTRON DENSITY AND THE ELECTRIC FIELD IN A STEADY-STATE F-LAYER Scientific Report No. 283
Craig Comstock 16 Jan. 1966 32 p refs
(Grant NsG-134-61)
(NASA-CR-69203) CFSTI: HC $2.00/MF $0.50 CSCL 04A

A steady state solution is obtained to the equation for the electron density in an isothermal one dimensional model of the F-layer. The solution is an extension of a previous result of Bowhill to include the effects of different ion and electron temperatures and a more realistic electron production term. Simultaneously a solution is obtained for the steady state electric field necessary to maintain charge neutrality. This result is new and somewhat surprising. Considerable attention is paid to the possible boundary conditions for such a model and their effect on the solution. The effect of a plane parallel approximation on the boundary conditions is also included. Author

N66-15029# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO 249
30 Nov. 1965 97 p refs Transl. into ENGLISH from Chinese periodicals
(JPRS-33090; TT-65-33667) CFSTI: $3.00

CONTENTS:

1. RECENT DATA ON INDOLE ALKALOIDS—STRUCTURAL RELATIONSHIP AND IMPORTANT DEVELOPMENT IN RECENT YEARS Chung-liang Ch'en p 1–34 refs
2. PRELIMINARY STUDY OF THE CRYSTALLINE STRUCTURE OF GOLDICHITE Yu-p'u Ying p 35–39 refs
3. SALINE SOIL ON NORTHERN KIANGSU COAST, ITS FEATURES AND ITS IMPROVEMENT Shu-ying T'ang p 40–61 refs
4. AERIAL SOIL SURVEY AND CARTOGRAPHY. II. INTERPRETATION OF AERIAL PHOTOS OF THE HILLY REGION IN THE NORTH OF SUB-TROPICAL RED LOAM AREA Ch'ang-ta Tai, Hsing-wen Liu, and Mou-te Ts'ai p 62–76 refs (See N66-15030 05-13)
5. ANNOTATED TABLE OF CONTENTS OF CHINESE COMMUNIST JOURNALS ON GEOGRAPHY AND GEOLOGY p 77–83
6. BIG STRIDES MADE BY PEIPING'S HIGHER INSTITUTIONS OF LEARNING p 84–85

N66-15030 Joint Publications Research Service, Washington, D. C.
AERIAL SOIL SURVEY AND CARTOGRAPHY. II: INTERPRETATION OF AERIAL PHOTOS OF THE HILLY REGION IN THE NORTH OF SUB-TROPICAL RED LOAM AREA Ch'ang-ta Tai, Hsing-wen Liu, and Mou-te Ts'ai *In its* Transl. on Communist China's Sci. and Tech., No. 249 30 Nov. 1965 p 62–76 refs Transl. into ENGLISH from T'u-Jang Hsueh-Pao (Peking), v. 12, no. 4, Dec. 1964 p 442–449 (See N66-15029 05-13) CFSTI: $3.00

Aerial survey and photographic methods were used to draw a map of the hilly section of the red loam area located south

of the Yangtze river. Interpretations of black and white films, together with topographic observations of erosion and cultivation layers were used to analyze the various types of red loam and paddy soils and to draw the boundary of soil zones accurately. The resultant map was used to establish a link between soil distribution and farmland. G.G.

N66-15032# Joint Publications Research Service, Washington, D. C.
STUDIES IN ATMOSPHERIC PHYSICS
9 Dec. 1965 53 p refs Transl. into ENGLISH from Izv. Akad Nauk SSSR, Fiz. Atmosfery i Okeana (Moscow), v. 1, no. 9, 1965 p 1–46
(JPRS-33249; TT-65-33824) CFSTI: $2.00

CONTENTS:

1. ATMOSPHERIC PROPAGATION OF A HEAVY IMPURITY RELEASED BY A POINT SOURCE Ya. S. Rabinovich p 1–13 refs (See N66-15033 05-13)

2. INVESTIGATION OF THE SPECTRAL COMPOSITION OF SHORT-WAVE SOLAR RADIATION K. Ya. Kondrat'yev, M. P. Burgova, V. V. Mikhaylov, and V. S. Grishecklin p 14–30 refs (See N66-15034 05-13)

3. SPECTRAL DISTRIBUTION OF REFLECTED TERRESTRIAL RADIATION IN THE OZONE ABSORPTION BAND 0.20–0.34μm T. A. Germogenova and M. S. Alkevich p 31–46 refs (See N66-15035 05-13)

N66-15033 Joint Publications Research Service, Washington, D. C.
ATMOSPHERIC PROPAGATION OF A HEAVY IMPURITY RELEASED BY A POINT SOURCE
Ya. S. Rabinovich *In its* Studies in Atmospheric Phys. 9 Dec. 1965 p 1–13 refs (See N66-15032 05-13) CFSTI: $2.00

Turbulent diffusion of a heavy impurity entering the atmosphere from a stationary point source high above the ground was analyzed. The spatial symmetrical distribution of a smoke impurity was evaluated as a product of Gaussian distribution of data on the particle diameter and the rate of precipitation. It was found that gravitational forces exert an equalizing effect on the dependence of particle surface concentrations in meteorological conditions. An increase in intensity of turbulent mixing increased also the relative contribution of the particle weight factors to the value of the surface condition and thus influenced the falling rate of particles. G.G.

N66-15034 Joint Publications Research Service, Washington, D. C.
INVESTIGATION OF THE SPECTRAL COMPOSITION OF SHORT-WAVE SOLAR RADIATION
K. Ya. Kondrat'yev, M. P. Burgova, V. V. Mikhaylov, and V. S. Grishechkin *In its* Studies in Atmospheric Phys. 9 Dec. 1965 p 14–30 refs (See N66-15032 05-13) CFSTI: $2.00

The spectral composition of short-wave radiation fields at the level of the earth's surface were studied by high-speed spectrometer, and a method to determine the spectral fluxes of total and scattered radiation in absolute units of energy was developed. Observations from Odessa, Russia, showed that the maximum surface spectrum (480 mμ) was displaced at 20 mμ relative to the extra-atmospheric spectrum; a broad absorption band near 430 mμ was not identified and was attributed to probable extra-atmospheric origin. Measurements of the spectral brightness at various wavelengths and at different scattering angles confirmed the aerosol character of scattering radiation. Data on spectral fluxes of total and scattered radiation, atmospheric transparency, indicatrices of scattering, and albedo of the underlying surfaces were used to find simple numerical approximations for the fields of short-wave radiation. G.G.

N66-15035 Joint Publications Research Service, Washington, D. C.
SPECTRAL DISTRIBUTION OF REFLECTED TERRESTRIAL RADIATION IN THE OZONE ABSORPTION BAND 0.20-0.34 μm
T. A. Germogenova and M. S. Alkevich *In its* Studies in Atmospheric Phys. 9 Dec. 1965 p 31–46 refs (See N66-15032 05-13) CFSTI: $2.00

Computations on the composition of reflected terrestrial radiation at the spectral interval 0.20 to 0.34 μm for a Raleigh atmosphere at different positions of the sun and at different directions of observation, are presented. The vertical ozone distribution was taken from rocket measurement data at 70 km and extrapolated to the 100 km level. Values for optical thicknesses and assumed ozone distributions were computed for each wavelength for a model atmosphere whose density varied exponentially with height and in which there was Raleigh scattering of radiation on air molecules and absorption by ozone molecules. Differences between the computed values and actual satellite measurement on the spectral distribution of outgoing radiation were attributed to aerosol scattering of the solar radiation. G.G.

N66-15039 Joint Publications Research Service, Washington, D. C.
CONDITIONS FOR THE ADDITIVITY OF THE REFRACTIVE INDEX
Ta-nien Yeh *In its* Transl. on Communist China's Sci. and Tech. 21 Dec. 1965 9 p refs Transl. into ENGLISH from K'O-hsueh T'ung Pao (Peking), no. 9, Sep. 1965 p 816–819 (See N66-15037 05-34) CFSTI: $2.00

The necessary conditions for the additive property of refractivity is discussed and the additivity of the refractive index in alum compounds is examined in detail. It is shown that an analysis of the conditions for the additive property of the refractive index can clarify the relationship between the optical property and the composition of solid solutions. These conditions can be used as a standard for determining the rigidity of available charts and diagrams. They can also be employed to determine if there is a practical significance when the refractive index and composition in the solid state are consistent with the principle of additivity. For example, since the chemical bonds of S and Se in a S-Se alloy differ greatly, they are not consistent with the principle of additivity. E.E.B.

N66-15040 Joint Publications Research Service, Washington, D. C.
THE INFLUENCE OF THE PROPERTY OF COORDINATION POLYHEDRA OF COMPLEX ANIONS IN OXYSALT ON THE DISTRIBUTION OF THE DOUBLE REFRACTIVE INDEX
Ta-nien Yeh *In its* Transl. on Communist China's Sci. and Tech. 21 Dec. 1965 14 p refs Transl. into ENGLISH from K'o-Hsueh T'ung Pao (Peking), no. 9, Sep. 1965 p 819–822 (See N66-15037 05-34) CFSTI: $2.00

The regularity of the distribution of the double refractive index in silicate, sulfate, phosphate, arsenate, vanadate, carbonate, and borate minerals and its relation to the property of the coordination polyhedra of complex anions are discussed. The distribution of the double refractive indexes of major types of minerals are tabulated and curves showing the distribution

of the double refractive indexes of various types of minerals are given. Due to the fact that the plane trigonal in carbonate minerals is strongly anisotropic, the double refractive index is large and the range of distribution exceeds those of other oxysalt minerals. Approximately 90% of the silicate minerals have double refractive indexes below 0.055. A similarity between the crystal structure of borate and silicate minerals is noted. Nearly 70% of these minerals have double refractive indexes lower than 0.055. E.E.B.

N66-15093# Atomic Energy Commission Research Establishment, Riso (Denmark).
A NOTE ON THE SIMILARITY HYPOTHESIS FOR WIND PROFILES
Niels Eduard Busch May 1965 27 p refs Sponsored by Tech. Univ. of Denmark
(RISO-100)

From calculations performed on wind and temperature data measured at the Argonne National Laboratories it is concluded that under unstable conditions of stratification the wind and temperature profiles are appraoximately similar with a tendency for $\alpha_i = K_M/K_H$ to decrease with increasing height. Here K_M and K_H are the eddy viscosity and eddy heat conductivity respectively. No systematic trends towards variation of the rate of decrease with stability could be noted. A comparison of the results yielded by the Argonne data with results obtained at the Risö site gives evidence of the existence of a free convection regime in very unstably stratified air in which the vertical heat flux is independent of wind shear (Priestley regime). In the case of stable conditions the wind and temperature profiles appear to be approximately similar under stability conditions characterized by Richardson numbers less than 0.1. In a more stable atmosphere the profiles are consistently dissimilar, which indicates a decrease of K_M/K_H with increasing height. In the case of stable stratification the flow changes character at a Richardson number of ca. 0.2, suggesting this to be the critical value for completion of the turbulence decay. Author (NSA)

N66-15108*# Michigan Univ., Ann Arbor. Electron Physics Lab.
THERMAL RADIATION FROM THE IONOSPHERE Technical Report No. 84
H. C. Hsieh Apr. 1965 58 p refs
(Grant NsG-696)
(NASA-CR-69190) CFSTI: HC $3.00/MF $0.50 CSCL 04A

The ionosphere is considered as a dissipative medium in which random thermal motions of charged particles act as a thermal radiation source. Electrons colliding with ions and neutral particles in the ionosphere are emphasized. An analytic method is developed with Maxwell and Langevin equations based on a linear, macroscopic, fluctuating electromagnetic field theory. The spectral density of the random current source function is derived in terms of the conductivity tensor of the ionosphere. The ionosphere is divided into many incremental volume elements, each containing an ionized medium representing an anisotropic radiating system, characterized by the spectral density of the source function. The radiation characteristic of the radiating system observed at a point outside the source is obtained using potential functions which relate thermal electromagnetic fields at the observation point to their source function. Expressions are derived for the thermal noise power generated per unit bandwidth from any ionospheric source region, and for the available thermal noise power per unit bandwidth at a receiving antenna. These expressions are valid for most regions where the electron collision process plays a major role in thermal radiation and are not limited in a frequency range. R.N.A.

N66-15109# Library of Congress, Washington, D. C. Aerospace Technology Div.
PHENOMENA IN THE UPPER ATMOSPHERE SURVEYS OF COMMUNIST WORLD SCIENTIFIC AND TECHNICAL LITERATURE
Edward Gelins 7 Dec. 1965 66 p refs Comprehensive Rept. (ATD-65-81)

An annotated bibliography is presented on upper atmospheric phenomena. References are included on the ionosphere and electromagnetic wave propagation, cosmic radiation and the radiation belts, telluric currents, geomagnetism, whistlers, satellite and missile electromagnetic wave propagation, and auroras and electromagnetic wave propagation. R.N.A.

N66-15149 Joint Publications Research Service, Washington, D. C.
PROBLEMS OF ATMOSPHERIC PROBES
Chen-Ch'ao Ku *In its* Transl. of Communist China's Sci. and Technol., No. 270 27 Dec. 1965 p 51–59 Transl. into ENGLISH from K'o Hsueh T'ung Pao (Peking), no. 8, Aug. 1965 p 700–704 (See N66-15147 05-13) CFSTI: $3.00

The recording and use of meteorological data for weather forecasting is discussed. Reviewed are methods of measurement, instrumentation, and improvement of data. Problems pertaining to atmospheric pressure variations, humidity, turbulence, and temperature are discussed. The observation and identification of micro-pressure waves caused by atomic explosions is considered as a means of detecting atomic explosions. L.S.

N66-15154 Joint Publications Research Service, Washington, D. C.
THE HYPOTHESIS OF THE ORIGIN OF THE EARTH
Ch'eng-i Fu *In its* Transl. on Communist China's Sci. and Technol., No. 274 5 Jan. 1966 p 17–22 refs (See N66-15151 05-34 CFSTI: $3.00

While available evidence is fragmentary, it is pointed out that more people are accepting low temperature concepts of the origin of the earth. Consideration must also be given to a liquid origin concept, according to this brief review, because many things cannot be explained by newly-advanced theory. Two hypotheses are presented and some solar system characteristics are discussed. M.W.R.

N66-15155 Joint Publications Research Service, Washington, D. C.
THE AGE OF THE EARTH
Wen-Po Weng *In its* Transl. on Communist China's Sci. and Technol., No. 274 5 Jan. 1966 p 23–30 refs (See N66-15151 05-34) CFSTI: $3.00

A review of man's efforts to measure the age of the earth discusses the periodic properties of isotopes and the age of elements on the earth. Relative abundance of certain isotopes is tabulated, and the age of potassium is estimated to be 5.6×10^9 years. Three methods given for estimating the relative original abundance of lead are based on periodicity of isotopes; the assumption that lead maintains its original ratio in meteorites; and a ratio between old rocks and lead isotopes. The method for determining the age of rocks is considered more direct and accurate. The oldest rock is about 3.9×10^9 years, but in China and the Far East there are no rocks as old as this. Earth substances are estimated to have been created between 4.8 and 6.8×10^9 years ago, whereas the estimate for earth shell formation is between 4.5 and 4.6×10^9 years ago. M.W.R.

N66-15183# Allis-Chalmers Mfg. Co., Milwaukee, Wis.
PRESSURE GRADIENTS IN BRIDGMAN ANVIL DEVICES
L. C. Towle and R. C. Riecker (AFCRL) Bedford, Mass., AFCRL, Sep. 1965 42 p refs *Its* Instrumentation Papers No. 81 (ARPA Order 292; Proj. Vela Uniform)
(AFCRL-65-707; AD-623933) CFSTI: HC $2.00/MF $0.50

Experimental evidence regarding pressure gradients in Bridgman anvil devices is reviewed and some new experimental data are presented. Although there are many differences in details, all the experimental evidence is found to fit a general pattern. A simple empirical relationship describing the pressure distribution is derived which is consistent with experimental observation. The experimentally determined pressure is used to estimate errors introduced into various types of anvil experiments by pressure gradients. Numerical values for the correction factors are given in graphical form for a wide range of experimental conditions. Analysis of shear experiments indicates that pressure gradients are much smaller under dynamic conditions. Analysis also shows that the peripheral sample region which is partially nonload-supporting frequently has a greater detrimental effect on anvil experiments than does the pressure gradient which exists over the central portion of the sample cell. Author (TAB)

N66-15184# University Coll. of Wales, Aberstwyth. Dept. of Applied Mathematics.
LARGE SCALE MOVEMENTS OF THE ATMOSPHERE Final Scientific Report
T. V. Davies, D. W. Beard, and Kaye R. James 30 Jun. 1965 120 p refs
(Contract AF 61(052)-690)
(AFCRL-65-775; AD-623667) CFSTI: HC $4.00/MF $0.75

The broad aim of the paper is to attempt to understand the dynamical response of the atmosphere, in its tidal movements, to variations in ozone content. TAB

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N66-14373# European Atomic Energy Community, Brussels (Belgium).
APPARATUS FOR THE MEASUREMENT OF DIFFUSIVITY AT HIGH TEMPERATURES [DISPOSITIF DE MESURE DE LA DIFFUSIVITE A HAUTES TEMPERATURES]
M. Van Den Berg and H.-E. Schmidt 1965 35 p refs In FRENCH; ENGLISH summary
(EUR-2424.f) CFSTI: HC $2.00/MF $0.50

An apparatus is described which permits rapid measurement of thermal diffusivity of samples 5 mm in diameter and up to 1 mm thick, at temperatures from 1000° C to 2200° C. The sample is heated by electron bombardment. A periodic small amplitude variation of the beam power produces corresponding temperature variations on the two sample faces. The phase shift is recorded and permits the calculation of the diffusivity. The temperature is measured with a two-color-type pyrometer. Measurements of diffusivity were made on tungsten, graphite, uranium dioxide single crystals, and pure and doped sintered uranium dioxide. The precision of the method was estimated to be of the order of ±10% for all measurements below 2000° C. Author (NSA)

N66-14426# General Precision, Inc., Pleasantville, N. Y.
WIDE ANGLE TELEVISION PROJECTION, VOLUME I, PHASES I AND II Final Engineering Report
Louis P. Raitiere and Urban H. Santone, Jr. Port Washington, N. Y., NTDC, Oct. 1964 158 p refs
(Contract N-61339-695)
(NAVTRADEVCEN 695-1; AD-621711) CFSTI: HC $5.00/MF $1.00

The common objective of Phases I and II of the contract was to design, modify, construct, and arrange television equipments to provide a wide angle television system for viewing target and background information, and to adapt or modify commercially available equipment for electronically inserting the target information into the background. Reported in detail at this time is the development of the camera lens which provides an angle of view of 159 degrees in azimuth, and which is considered a significant achievement, and an examination of Fiber Optic Bundles. Phase III of the contract, presently in the study phase, to be reported upon completion of this Project, will deal with the design and construction of the combined system to project a wide angle TV picture for the realistic presentation of a trainee environment. Author (TAB)

N66-14453# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.
THERMAL-BRIDGE COMPENSATION FOR SQUARE-WAVE DRIVE
Kenneth W. Kaiser Aug. 1965 15 p
(Contract AF 04(694)-553)
(E-1794; AD-623099) CFSTI: HC $1.00/MF $0.50

Square-wave excitation of the temperature-sensing bridge in the thermal jacket of a precision gyroscope can result in improper operation of the temperature controller. A model of such a bridge is constructed using frequency-response data and the physical layout of the bridge. A successful compensation technique to allow satisfactory operation with square-wave excitation is then derived from the model. TAB

N66-14491# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
THE "EVAPOTRON": AN INSTRUMENT FOR THE MEASUREMENT OF EDDY FLUXES IN THE LOWER ATMOSPHERE
A. J. Dyer and F. J. Maher 1965 32 p refs *Its* Div. of Meteorological Phys. Tech. Paper No. 15 CFSTI: HC $2.00/MF $0.50

The principles underlying the eddy correlation technique for the measurement of the vertical fluxes of heat and water vapor in the lower atmosphere are outlined. An instrument embodying these principles (the Evapotron) is then described in detail, and the operational aspects of the technique are discussed. The method consists of detecting, above the surface in question, the rapid fluctuations of temperature, humidity, and the vertical component of air velocity. The instantaneous multiplication of each of the first two parameters with the vertical component enables the vertical fluxes to be obtained by integration. Wet and dry bulb thermometers employing very fine wire elements record the rapid fluctuations of temperature and humidity. A heated-wake anemometer, of unique design and also using fine wire elements, measures the vertical component of air velocity. From 400 c/s bridges, signals proportional to the relevant parameters are obtained by means of special circuitry. Multiplication and integration is carried out by modified watt-hour meters. Energy balance measurements and comparison with lysimeter observations demonstrate the validity of the method. Author

N66-14517# Technische Hochschule Darmstadt (West Germany). Institut fuer Stromungslehre und Hydraulische Maschinen.

SIMPLE METHODS AND INSTRUMENTATION FOR VERY SHORT EXPOSURE, HIGH REPETITION RATE KINEMATOGRAPHY IN CONJUNCTION WITH FLUID ATOMIZATION STUDIES Final Report

F. N. Scheubel, A. Fritzsche, and H. Wendt Aug. 1965 51 p refs (Contract AF 61(052)-651)

(AFCRL-65-774; AD-623569) CFSTI: HC $3.00/MF $0.50

The high voltage discharge of a pulsed light source with coaxial capacitor and extremely low inductance (Fischer-Nanolite) was employed successfully for ultra-short-time exposure of rapidly changing phenomena in the boundary layer of two-phase-flow. Design and operation of the electronic trigger-unit controlling high voltage discharge and shot series limitation are described. The high speed cameras and the lighting device developed in this way were used to investigate the atomization of liquids. In order to study the disintegration itself it is necessary to get distinct exposures of particles in the order of some hundredth of a millimeter and velocities of more than one hundred meters/second. A simple calculation indicates that exposure times in the nanosecond range are required. TAB

N66-14690# Library of Congress, Washington, D. C. Aerospace Technology Div.

OPTICAL DETECTION Surveys of Soviet Scientific and Technical Literature

Frederick Pindy 6 Dec. 1965 18 p refs Compilation of abstracts (ATD-65-84)

Abstracts of articles dealing with optical detection, published in the Soviet Union, are presented under the headings of image perception and scanning, informational content of images, and image improvement. M.W.R.

N66-14718# National Cash Register Co., Dayton, Ohio. Advanced Technology Dept.

HIGH RESOLUTION RAPIDLY PROGRAMMABLE MASKING FOR FUNCTIONAL ELECTRONIC BLOCKS, PHASE II

15 Nov. 1965 29 p ref

(Contract AF 33(615)-1158)

(ITR-2; AD-623727) CFSTI: HC $2.00/MF $0.50

Major accomplishments of the report period are discussed. Efforts directed toward design and fabrication of a fully automated Phase II Microscribe Maskmaker were (1) completion of the design study and the final design of an x-y platform and drive mechanism, (2) completion of the design study and the final design of a multiple image optical system, (3) completion of the illumination system design and mock-up, and (4) fabrication of the major portion of the control unit assembly. Author

N66-14720# Systems Research Labs., Inc., Dayton, Ohio.

TEST AND EVALUATION OF ELECTRONIC IMAGE GENERATION AND PROJECTION DEVICES. VOLUME I: EVALUATION TECHNIQUE Final Report, Jul. 1964–Jul. 1965

John H. Harshbarger Wright-Patterson AFB, Ohio, AMRL, Aug. 1965 50 p refs

(Contract AF 33(615)-1889)

(AMRL-TR-65-116, Vol. I; AD-623908) CFSTI: HC $2.00/MF $0.50

A method is described for evaluation of all types of displays in terms of resolution, brightness, and contrast ratio. The technique employs a television camera to replace human observation, and translates the characteristics of the display to measureable electronic waveforms. The waveforms are displayed on an oscilloscope where they may be analyzed directly and photographed, thus providing known standards of measurements in terms of electrical units rather than depending upon human judgment as a comparison standard. Direct evaluation may be applied to any display. The observer television camera furnishes data which are an expression of the display fidelity. Brightness is measured by a photometer. These terms are subsequently interrelated in an expression of the contrast ratio attainable at various resolution and brightness levels. The analytical evaluation, especially applicable to cathode ray tube (CRT) displays, obtains data through examination of the minute scanning spot as it traverses the image area. Analysis of the beam spot behavior enables one to predict the ultimate CRT capabilities without generating a complete display. Author (TAB)

N66-14996# CBS Labs., Stamford, Conn.

STUDY OF EFFECTS AND DEGREES OF ERROR OF MODULATION-DEMODULATION Final Report, Mar.–Sep. 1964

Edward J. Foster Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Jun. 1965 188 p refs

(Contract AF 33(657)-12481)

(CLD-1709; AFFDL-TR-65-6; AD-620673) CFSTI: HC $5.00/MF $1.00

A theoretical study of three modulation-demodulation methods for use in the VGH recorder was conducted. Emphasis was placed upon the suitability of each system for providing increased accuracy over low speed direct tape recording. The methods investigated were: (1) frequency modulation, (2) pulse duration modulation and (3) digitial coding. The study included a general spectrum analysis, the signal-to-noise improvement available, and aliasing effects. Characteristics of each method investigated: in the frequency modulation system—the effect of an imperfect limiter and the use of a multivibrator modulator and pulse averaging discriminator; in the pulse duration modulation system—the comparator method of generating the signal; in the digital system—analog-to-digital and digital-to-analog conversion was analyzed with regard to sampling effects and conversion inaccuracies. A seven-pole Butterworth low pass filter of the active type was designed and constructed to eliminate the aliasing problem. Laboratory performance proved suitability of the unit for use as an input filter. Author (TAB)

N66-15011# Atomic Energy of Canada, Ltd., Chalk River (Ontario).

LARGE-VOLUME COAXIAL GERMANIUM GAMMA-RAY SPECTROMETERS

H. L. Malm and I. L. Fowler Oct. 1965 36 p refs Presented at the IEEE 12th Nucl. Sci. Symp., San Francisco, 18–20 Oct. 1965

(AECL-2504; CRGP-1224) CFSTI: HC $2.00/MF $0.50

Germanium lithium-drift p-i-n diodes for high resolution γ-ray spectroscopy have been made with sensitive volumes in the range 16 to 54 cm^3 using the coaxial method of drift. Details of the construction, mounting, and preparation as spectrometers are given. The shape of the undrifted p-type core has been determined by scanning with a collimated γ-ray beam and by copper plating the surface of a secioned diode. The characteristics as spectrometers, using γ-rays of energies in the range 0.1 to 7.5 MeV, are shown. Intrinsic full energy peak efficiencies are shown for different diode sizes over a range of γ-ray energies. For the 54 cm^3 volume diode, these efficiencies are 21% and 8% respectively for γ-ray energies of 0.5 and 1.0 MeV with a source to diode distance of 30 cm. The larger diodes show a greatly enhanced peak/total ratio, and the higher efficiencies make these spectrometers extremely useful in reaction γ-ray, γ-γ coincidence, and n,γ studies. Author

N66-15115 Catholic Univ. of America, Washington, D. C. Dept. of Electrical Engineering.
PRECISION PHOTO-ELECTRONIC FUELMETER
Joseph C. Michalowicz *In its* Elec. Eng. Res. Rev., No. 4 Jun. 1965 p 21–27 *ref* (See N66-15112 05-34)

Precision fuel consumption measuring devices for passenger cars and commercial vehicles are discussed in terms of advantages and disadvantages and general operating characteristics. Descriptions are included on the buret type and volumetric positive-displacement type fuelmeters. A photo-electronic fuelmeter was developed which retains the advantages of the buret system for accurate, precise, and dependable service, but provides an electronic means for both detecting and presenting, as simple digital information, actual fuel consumption information, and for automatically operating the valves controlling fuel flow into and out of the burets. A more detailed account of the photo-electronic fuelmeter's operating characteristics along with its counting and refilling operations is presented. R.N.A.

N66-15126# Central Lab. TNO, Delft (Netherlands).
MEASUREMENTS OF WALL-THICKNESS VARIATIONS BY LONG STRAIGHT TUBES, DESCRIPTION AND APPROVEMENT OF DEFINITE MEASURING DEVICE [METING VAN VARIATIES IN WANDDIKTE BIJ LANGE RECHTE BUIZEN. BESCHRIJVING EN BEPROEVING VAN DE DEFINITIEVE MEETOPSTELLING]
A. C. Meijer and P. Platzek Brussels, EURATOM, 1965 40 p refs In DUTCH; ENGLISH summary
(Contract EURATOM-002-61-12 IRAN)
(EUR-2512.n) CFSTI: HC $2.00/MF $0.50

This report contains a description of a device for the semi-automatic measuring of wall-thickness variations in 76 cm long straight tubes, with internal diameters ranging from 5 to 40 mm. The radiation source of 25 mC Sr-90 is mounted in the tube, with the window of the ionization chamber at a distance of 61 mm from the source. Automatic scanning at a speed of 2–40 mm/sec^{-1} is possible along the tube and can be repeated after manual rotation of the angle. The scanning of 5–8 descriptive lines is regarded as sufficient, so that a complete check of 1 m of tubing can be carried out within 10–20 min, depending on the diameter and the desired accuracy. The wall-thickness can be 0.2–0.6 mm in the case of brass and steel and 0.6–1.8 mm in that of aluminum tubes. Author

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N66-14376*# Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF LARGE-INTERNAL-SURFACE-AREA NICKEL-METAL PLAQUES Final Report, Jun. 16, 1964–Sep. 30, 1965
J. Mc Callum, G. R. Schaer, D. G. Trevethan, and C. L. Faust 30 Sep. 1965 133 p *refs*
(Contract NAS3-6003)
(NASA-CR-54831) CFSTI: HC $4.00/MF $1.00 CSCL 13H

Porous nickel electrodes having preselected pore sizes and pore shapes were made. They were impregnated with cadmium in various forms and evaluated as rechargeable cadmium electrodes. The results showed a need to understand the changes that occur with cycling of cadmium electrodes. Impregnation of active cadmium into the porous nickel plaque was found to be a critical variable. The use of fused cadmium nitrate hydrate followed by a hot soak in potassium hydroxide solution was found to be preferred. Additional ways to decrease the weight of cadmium electrodes were implied by the results obtained: (1) The weights of active positive and negative materials should be more closely balanced stoichiometrically. (2) Pore volumes should be filled more than the present commercial practice of about 40 percent. (3) Electrode plaques should have straight-through pores with electrode thickness equal to about twice the pore diameters. Author

N66-14427# Beryllium Corp., Reading, Pa.
PRODUCTION ENGINEERING MEASURE FOR BERYLLIUM OXIDE AND PARTS PRODUCED FROM IMPORTED ORES Quarterly Progress Report, 1 Jan.–31 Mar. 1965
J. F. Blum and H. F. Lebo [1965] 45 p
(Contract DA-36-039-AMC-01481(E))
(QPR-7; AD-619374) CFSTI: HC $2.00/MF $0.50

Four uniform powder batches were prepared in the pilot plant using processes developed for this contract. The powder batches met all tentative specifications. A fabrication mix was prepared from each powder batch. The mixes met all chemical and physical property specifications. Test specimens were produced from each powder batch using pressing conditions, green densities, and firing schedules approximating conditions that will be employed to produce the final parts for the contract. The final specimen sizes and property measurements were as per MIL-I-10A requirements. Dielectric constant and loss factor values measured at one megacycle, met required specifications. Flexural strength values met required specifications. Thermal conductivity results at 100F and 280F were equal to or greater than proposed specifications set earlier for quality BeO ceramics. Author

N66-14438# IIT Research Inst., Chicago, Ill.
DEVELOPMENT OF THE DETAILED PLAN FOR A RELIABILITY CENTRAL, VOLUME I Final Report, Apr. 1964–Feb. 1965
M. E. Goldberg, R. S. Hollitch, G. T. Jacobi, H.. A. Lauffenburger, and E. S. Schwartz Griffiss AFB, N. Y., RADC, Oct. 1965 231 p refs
(Contract AF 30(602)-3426)
(IITRI-E6018-3; RADC-TR-65-94, Vol. I; AD-623195) CFSTI: HC $6.00/MF $1.25

Reliability data on electronic components is essential for Air Force System designs, procurement and specification review. This report delineates the functions and methods of operation of a Reliability Central adequate to meet these requirements. It constitutes an implementation study leading in progressive steps to an operation which will perform data collection, retrieval and analysis over a wide spectrum of electronic component parts. Diverse users of analyses both within and outside the Air Force are considered in detail. The report describes the required classes of data, a data processing system required for its acceptance, retrieval and analysis, and provides detailed description of the proposed outputs and services. Volume One describes the proposed implementation plan and recommendations. Volume Two contains more detailed technical information, backup and rationale for these recommendations. Author (TAB)

N66-14463# SKF Industries, Inc., King of Prussia, Pa. Research Lab.
A BASIC STUDY OF THE SLIDING CONTACTS IN ROLLING BEARINGS, PROJECT II Progress Report No. 2, Jul. 17–Oct. 16, 1965
C. J. Belsky, W. E. Schmidt, J. A. Kamenshine, K. Tataiah, and J. I. Mc Cool [1965] 122 p refs
(Contract NOw-65-0182-f)
(AL65L081; AD-623665) CFSTI: HC $4.00/MF $0.75

A 2-ball test machine, especially designed for sliding tests and capable of being used with irradiated balls for purposes of wear determination, was used to determine the load-speed relationship at the initiation of smearing failure in a sliding 2-ball configuration for three highly refined mineral oils and three ester-type lubricants. A configuration of three crowned cylindrical rollers was operated between two flat thrust washers in the presence of a non-metallic cage. The elastohydrodynamic film condition between rollers and flat washers was determined using a previously developed contact conductivity method. Preliminary surface microgeometry trackings were made on the test elements and the required modification of statistical theories relating conductivity results to the film thickness/roughness ratio was accomplished. Kinematical studies were made of the axial roller motion and skew of cylindrical rollers running in a conventional cylindrical roller bearing with flanged outer ring, in aligned or misaligned conditions. TAB

N66-14465# Naval Ordnance Test Station, China Lake, Calif. Michelson Labs.
A CRITICAL LOOK AT ULTRASONIC WELDING
Thomas H. Hazlett Oct. 1965 10 p refs *Its* Tech. Article 18
(NOTS-TP-3518; AD-623301) CFSTI: HC $1.00/MF $0.50

This technical article reviews the state of the art of ultrasonic welding and discusses some of the advantages and disadvantages of the process. It examines several theories of the nature of the bond; factors affecting the strength of the bond; and the mechanisms and applications of the process. It concludes that although ultrasonic welding appears to be an attractive process, fundamental and applied research is necessary before it will find its special place in the field of joining similar and dissimilar metals. Author (TAB)

N66-14469# Southwest Research Inst., San Antonio, Tex.
FUNDAMENTAL INVESTIGATION OF MOLYBDENUM DISULFIDE AS A SOLID LUBRICANT Final Technical Report, Jul. 23, 1964–Jul. 22, 1965
J. C. Tyler and P. M. Ku 23 Aug. 1965 70 p refs
(Contract NOw-64-0545-f)
(RS-460; AD-623484) CFSTI: HC $3.00/MF $0.75

A basic test facility for performing compression, tension, torsion, cohesion, adhesion, and sliding experiments on cylindrically shaped molybdenum disulfide (MoS_2) specimens in a controlled atmosphere or in vacuum was designed, fabricated, and put into operation. Compacts of a reference MoS_2 powder and a commercially available MoS_2 powder were made, without the use of a binder, over a wide range of compacting pressures and length-to-diameter ratios. Data were obtained on the variations of compact specific gravity and hardness with respect to compacting pressure and length-to-diameter ratio. Measurements were also made on the compressive and tensile properties of the MoS_2 specimens in clean dry air and at room temperature. The ultimate compressive and tensile strength were determined over a wide range of specimen specific gravities, as were the moduli of elasticity in compression and tension. Author (TAB)

N66-14554*# Kollmorgen Corp., Northampton, Mass.
THE COMMUTATORLESS TORQUER Final Report
A. Heyman 15 Sep. 1965 28 p refs
(Contract NAS8-11600)
(NASA-CR-69101; ER671.9) CFSTI: HC $2.00/MF $0.50
CSCL 13I

Performance test data on the brushless torquer model are summarized, and final test data on the two engineering models are presented. The development of the prototype model is reviewed, and the problem areas identified. Details are given on design improvements in developing the engineering models, and the test methods, including a tabulation of errors in the equipment used, and the uncertainties in torque ripple, linearity, and maximum torque measurements are described. Test data indicated that (1) the torque ripple for the complete system is 12%, well above the specification of 5%; (2) the one cycle per shaft revolution ripple could be decreased by reducing the eccentricity in the test stand; and (3) the total supply current at peak torque is 2.30 amperes, which is greater than the 2.00 amperes maximum available. Data sheets and graphs are included. M.G.J.

N66-14561# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYDRAULIC BALL LOCK FOR CONNECTING AND DISCONNECTING SECTIONS OF AIRBORNE EQUIPMENT
A. P. Pyatakov, M. M. Kolobashkin, and S. P. Snoval'shchikov 21 Sep. 1965 6 p Transl. into ENGLISH from Soviet Patent no. 161601 (Appl. no. 796966/25-8), 29 Sep. 1962 1 p
(FTD-TT-65-515/1+2+4; AD-622448) CFSTI: HC $1.00/MF $0.50

The object of the invention is a hydraulic ball lock for connecting and disconnecting sections of flying (airborne) equipment which has a spring piston compressing in the radial direction balls, which are located in openings in the cylinder of the piston. For the purpose of simultaneously connecting and disconnecting several connecting tenons of sections of the airborne apparatus, it is provided with a stationary race and a race held movable by balls, set on the outer surface of cylinder segments of the connecting tenons, such segments forming in the closed position of the lock a ring with two cones, which enter the inner conical bores of the races. A pneumatic differential piston, which acts on a volume of operating fluid included in the bore of the spring piston is used as a reinforcer of the lock. TAB

N66-14567# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL STABILITY OF ANTIWEAR ADDITIVES IN LUBRICATING OILS
A. M. Ravikovich, Ye. I. Petyakina, and P. P. Bagryantseva 17 Sep. 1965 10 p refs Transl. into ENGLISH from Khim i Tekhnol. Topliv i Masel (Moscow), no. 12, 1964 p 44-47
(FTD-TT-65-867/1+4; AD-622474) CFSTI: HC $1.00/MF $0.50

Use of a four-sphere friction machine to evaluate anti-scratching and antiwear properties of oils is discussed, and the test methods are described. Results indicate that anti-scratching admixtures containing sulfur, chlorine, and lead do not improve the antiwear properties of mineral oils while admixtures containing phosphorus exhibit an antiwear effect. A method developed to determine thermal stability (TS) of antiwear admixtures is also described. It is applicable for working concentrations of admixtures in lubricating oils, and permits the evaluation of the wear resistant effect of the admixture and oil soluble products of its decomposition. The admixture solution in oil is poured into a hermetically capped small stainless

steel receptacle, which is heated in an aluminum bath arrangement at a given temperature for a specified length of time, cooled, filtered, and tested on a four-ball friction machine. Formulas are given for the admixtures tested, the decomposition temperatures of each are tabulated, and the TS values are listed. It was shown that the decomposition point of dialkyldithiophosphate additives depends to a considerable degree upon the nature of the oil and the presence of other additives. M.G.J

N66-14605# Aerospace Industries Association of America, Inc., Washington, D. C.
THE EFFECTS OF SPACE RADIATION UPON CONNECTOR MATERIALS AND FINISHES
Dec. 1965 136 p refs
(EETC-32)

This report provides a physical insight into the composition and environment of space in the vicinity of the Earth, as well as, to describe its effect upon the various types of materials used to fabricate connectors; such as, metals, ceramics, elastomers, and plastics. Hence, the basic environmental conditions encountered by a connector during a typical ballistic missile trajectory through space, in the vicinity of the Earth, from launch to re-entry and landing, are defined. The effects of each portion of the various environments encountered by the connector, at each stage of the ballistic missile's trajectory, upon the families of materials comprizing the connectors are defined with particular emphasis applied to the physical mechanisms which cause material damage to take place. State of the art material tolerance limits, with respect to radiation and vacuum damage, for various families of insulating materials are presented. Author

N66-14678# TRW, Inc., Cleveland, Ohio. Accessories Div.
ENDURANCE TEST OF AN-1 ROLLER GEAR DRIVE
Ft. Eustis, Va., Army Aviation Mater. Labs., Aug. 1965 52 p ref *Its* Eng. Rept.-6371
(Contract DA-44-177-AMC-30(T))
(USAAVLABS-TR-65-31; AD-471437)

This report presents a review of the 1000-hour endurance test of the roller gear power transmission. The primary purpose of this program was to determine the feasbility of roller gear drive arrangements for power reductions in helicopter transmissions and to determine critical design parameters for the drive. An endurance run was made for 1000 hours on two roller gear drives mounted in a back-to-back test rig with a 200-horsepower load applied continuously with the high-speed shaft at 28 000 RPM and the low-speed shaft at 600 RPM in each box. An instrumentation system was provided to measure loads, speeds, oil flows, and temperatures, and to measure vibration levels. The test has confirmed that the roller gear drive is feasible for helicopter power reductions and has the ability to accept high input speeds and to accomplish high ratio reductions in one plane with very high efficiency, 98.5% or better with a high degree of mechanical reliability. Author (TAB)

N66-14758*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMIC INSTABILITY OF UNDAMPED BELLOWS FACE SEALS IN CRYOGENIC LIQUID
John C. Hudelson Washington, NASA, Jan. 1966 21 p refs
(NASA-TN-D-3198) CFSTI: HC $1.00/MF $0.50 CSCL 11A

The primary motions of an undamped bellows face seal are described along with the displacements and frequencies of the motions experienced during dynamic instability. Subminiature accelerometers were attached to the nosepiece of a 1-3/4-inch nominal shaft diameter bellows seal and the accelerations and frequencies recorded on magnetic tape for analysis at an expanded time factor. The results of the tests indicated that dynamic instability will occur in undamped bellows face seals operating in a cryogenic environment and be of such a magnitude as to damage the sealing surface causing excessive leakage. Variations in the pressure difference across the seal and in the contact load between the seal nosepiece and the mating surface did not change the characteristics of the dynamic instability. The primary motions of dynamic instability are diametral rocking and torsional oscillation. Author

N66-14784*# Standard Pressed Steel Co., Jenkintown, Pa.
EVALUATION OF FASTENERS AND FASTENER MATERIALS FOR SPACE VEHICLES
J. J. Glackin and E. F. Gowen, Jr. Washington, NASA, Jan. 1966 428 p refs
(Contract NAS8-11125)
(NASA-CR-357) CFSTI: HC $7.00/MF $2.25 CSCL 13E

High strength fasteners and fastener materials were evaluated to characterize those most suitable for space vehicle application at temperatures from −423° F (−253° C) to (871° C). A survey was undertaken to determine the space vehicle industry's present and future fastener requirements. The information obtained in the survey included present and future fastener materials, configurations, applications and design criteria, testing and test methods, and fastener information and specifications. As a result of the survey, twenty-one different classes of fasteners were selected for evaluation. The fasteners consisted of variations in tension and shear bolts, blind bolts, structural rivets, and companion fasteners fabricated from within the specified based alloys of iron, nickel, titanium, and aluminum. The fasteners were tested to determine the following properties or exposure effects: tensile, shear, stress rupture, stress relaxation, nut reusability, nut vibration, corrosion resistance, effects of thermal cycling, and the effects of relaxation on mechanical properties. M.R.W.

N66-15031# Joint Publications Research Service, Washington, D. C.
ON THE PROBLEM OF SELECTING PLACEMENT OF SCREW PROPELLERS IN MULTI-SHAFT SHIPS
Yu. F. Ryabkov 27 Dec. 1965 13 p refs Transl. into ENGLISH from Sudostroyeniye (Leningrad), no. 6, Jun. 1965 p 17–19
(JPRS-33474; TT-34048) CFSTI: $1.00

The jet boundaries of a screw propeller depend upon the operating regime of the propeller and the arrangement of the propeller relative to the ship's hull. Data of axial velocities in various sections of the jet from a screw propeller, together with boundary graphs, and the curvature caused by oblique flows were developed and are presented for consideration in propeller positioning on a multi-shaft ship. G.G.

N66-15036# Joint Publications Research Service, Washington, D. C.
ON THE PROBLEM OF QUALITY CONTROL OF THE GEOMETRICAL ELEMENTS OF SCREW PROPELLERS IN PRODUCTION
F. M. Katsman and G. M. Muzykantov 27 Dec. 1965 17 p Transl. into ENGLISH from Sudostroyeniye (Leningrad), no. 2, Feb. 1956 p 10–15
(JPRS-33471; TT-65-34045) CFSTI: $1.00

Various methods for quality control of the geometrical elements in the production of screw propellers are studied.

Drawings of screw propellers should provide 5 blade sections for pitch control; the shape of the cylindrical section of the blades is found by measuring the actual thicknesses; position of the blades along the axis of a screw propeller and their pitch are determined by measurements of the distance from a plane perpendicular to the axis of the propellers. Permissible deviations from the designated values are shown on a table. G.G.

N66-15083# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etude Nucléaires.
STUDY OF THE MACHINING OF URANIUM CARBIDE RODS OBTAINED BY CONTINUOUS CASTING UNDER ELECTRONIC BOMBARDMENT [ETUDE DE L'USINAGE DE BARREAUX DE CARBURE D'URANIUM OBTENUS PAR COULEE CONTINUE SOUS BOMBARDEMENT ELECTRONIQUE]
Pierre Rousset and Andre Accary Jul. 1965 40 p refs In FRENCH
(CEA-R-2733) CFSTI: HC $2.00/MF $0.50

Various methods of machining uranium monocarbide are considered and critically compared in the case of their application to uranium carbide obtained by fusion under an electronic bombardment and continuous casting. Two mechanical machining methods are proposed: cylindrical rectification and centerless rectification, preceded by a preliminary roughing out of a cylinder, the latter appearing more suitable. A study of the machining yields as a function of the diameter of the rough bars and of the diameter of the finished rods showed that an optimum value of the rough bar diameter exists for each value of the finished rod diameter. It was found that the yield increases as the diameter itself increases, this yield rising from 45 to around 70% as the diameter of the rough bars increases from 25–26 to 37–38 mm. Author (NSA)

N66-15092# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-12 Plant.
PRODUCTION-SIZE LATHE HYDROSTATIC COMPONENTS
P. J. Steger 21 May 1965 15 p Presented at the ASME Spring Lubrication Symp., New York, 7–9 Jun. 1965
(Contract W-7405-ENG-26)
(Y-DA-921; Conf-650651-1) CFSTI: HC $1.00/MF $0.50

Two lathe components using hydrostatic air bearings are described: a hydrostatic boring bar and a production-size spindle. Porous graphite bearing pads are used in both components. The accuracy and performance of the components are discussed. NSA

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N66-14356# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY NO. 259
9 Dec. 1965 18 p Transl. into ENGLISH from K'O-Hsueh Hua-Pao (Shanghai), no. 9, Sep. 1965 p 297–301
(JPRS-33257; TT-65-33832) CFSTI: $1.00

CONTENTS:
1. PROGRESS IN LASER I-Min p 1–7
2. LASER APPLICATION K'o-Hua p 8–15

N66-14573# Office of Naval Research, Washington, D. C.
LASER PHYSICS CONFERENCE
Robert E. Behringer [1965] 96 p refs Conf. held Des Plaines, Ill., 22–23 Mar. 1965; sponsored jointly by ARPA
(AD-622507) CFSTI: HC $3.00/MF $0.75

The Office of Naval Research sponsored an informal conference on fundamental problems in laser physics at the Concord Motel in Des Plaines, Illinois, on Monday and Tuesday, the 22nd and 23rd of March. The meeting was held primarily for the benefit of the ONR contractors receiving support from the Fundamental Limitations portion of the ONR/ARPA Laser Program. However, others interested in this aspect of the ONR/ARPA Laser Program were also invited to contribute to the meeting. Author (TAB)

N66-14591# Edgerton, Germeshausen and Grier, Inc., Bedford, Mass.
HIGH ENERGY LASER SYSTEM FOR GEODETIC RESEARCH Final Report, 1 Apr. 1963–2 Jul. 1965
Sumner Ackerman 30 Sep. 1965 159 p refs
(Contract AF 19(628)-2950)
(B-3011; AFCRL-65-671; AD-622715) CFSTI: HC $5.00/MF $1.00

The design, operation, and performance of a high-energy laser system developed specifically for geodetic satellite research are described. The ground-based laser illuminator uses a liquid-N_2-cooled 16-mm (diameter) by 184-mm (length) ruby crystal. It has a nominal ouput of 250 joules at 6935 A with 17 000 joules of pump supply and a pulse duration of 2.5 milliseconds. Discussion of the system's performance is based on 15 months of operating experience which has shown that high-energy lasers are practical for geodetic research applications requiring long periods of reliable operation under outdoor field conditions. The feasibility of Project LARGOS (Laser-Activated Reflecting Geodetic Optical Satellite), sponsored by the Terrestrial Sciences Laboratory of AFCRL, was verified experimentally using this equipment when clearly detectable star images of the Explorer 22 Satellite were obtained on 21 January, 29 January, and 3 February 1965 at ranges up to 925 statute miles. Range measurements by photoelectric detection were obtained simultaneously. A study was made of cube-corner reflectors suitable for satellite geodesy showing that, ideally, these should be almost diffraction limited with an aperture of the correct diameter to obtain the desired beamwidth. TAB

N66-14841# Aeronutronic, Newport Beach, Calif.
CHEMICALLY PUMPED LASER SYSTEM First Quarterly Progress Report, 26 Jun.–31 Jul. 1965
S. Byron, W. Kuby, W. Lawrence, and R. V. Finizie 31 Aug. 1965 31 p refs
(Contract DA-36-034-AMC-0325(T))
(U-3259; AD-622398) CFSTI: HC $2.00/MF $0.50

A summary is given of the state of the art in chemical pumping of lasers, the potential performance by various approaches is evaluated, and the specific approach chosen for further development under this contract is described. The program plan for the remainder of the contract is outlined and progress during the past quarter is described. During this quarter an experimental evaluation of various radiation coupling geometries and window materials led to a successful test in which laser action was produced in a ruby by shock heated xenon. A summary is also given

of earlier studies by the Bio-Technology Department of the Philco C and E Division, Blue Bell, Pennsylvania, which were directed toward measuring eye damage in monkeys by laser irradiation. Author (TAB)

N66-14672# American Optical Co., Southbridge, Mass. Research Div.
PREPARATION OF PLATINUM-FREE LASER GLASS Semiannual Technical Report, 1 Jan.–31 Jul. 1965
W. R. Pringle, G. A. Granitsas, and C. G. Silverberg [1965] 35 p ref
(Contract Nonr-4656(00); ARPA Order 306-62; Proj. Defender) (SATR-2; AD-471803)

It was demonstrated that the oxidation of platinum followed by the subsequent reduction of the oxide particles to the metal is a major source of inclusions in laser glasses melted in systems containing platinum. These glasses can be melted in platinum without inclusions if an inert atmosphere such as nitrogen or argon replaces oxygen in the system. Laser glasses prepared in this manner have given excellent performance in high energy laser devices. In a parallel but different approach to the elimination of platinum inclusions an all-ceramic melting system has been designed and constructed. This system, which utilizes special refractories and stirring techniques, is undergoing preliminary tests. Author

N66-14725# Korad Corp., Santa Monica, Calif.
SOLID STATE LASER DEVICES
R. H. Hoskins, R. C. Pastor, and I. M. Winer Sep. 1965 30 p refs
(Contract DA-36-039-AMC-00070(E))
(QPR-9; AD-624164) CFSTI: HC $2.00/MF $0.50

Toward meeting the objective of developing a solid state laser with an output in the megawatt range and a repetition rate in the kilocycle range, studies have been conducted on a continuously-pumped Q-spoiled YAG:Nd^{+3} laser. The results are reported here, along with an analysis of the behavior of such a system. Material studies on the systems Y_2O_3:Eu^{+3} and YbAG:Er^{+3} are also described. Author (TAB)

N66-14801# Aircraft Armaments, Inc., Cockeysville, Md.
RESEARCH ON THE ADAPTABILITY OF LASERS TO SCHLIEREN SYSTEMS Final Report
John A. Ackerman and Gordon A. Brill, Jr. Wright-Patterson AFB, Ohio, ARL, Jul. 1965 48 p
(Contract AF 33(615)-1914)
(ARL-65-139; AD-622394) CFSTI: HC $2.00/MF $0.50

The purpose of the present contract was to develop and produce a laser source for the 10 inch schlieren system presently in use at the Fluid Dynamics Facilities Laboratory of ARL. The source, which uses a He-Ne Gas Laser for continuous viewing in conjunction with a Q-switched ruby source for taking very short exposure time photographs, has been developed and incorporated into the existing system. Certain problems still exist which greatly limit the overall system performance, but these are due to factors such as vibration, temperature fluctuations, and the quality of the existing optical system. Recommendations are made for the development of an overall system which will allow the potential of the laser source to be realized. Author (TAB)

N66-14852# New York Univ., N. Y. Geophysical Sciences Lab.
OPTICAL SOUNDING II, PART I. STUDY OF ACTIVE PROBING OF WATER VAPOR PROFILES AND RESULTS OF EXPERIMENTS Final Report, 6 Nov. 1963–15 Jul. 1965
R. M. Schotland, D. Chang, and J. Bradley [1965] 100 p refs
(Contract DA-36-039-AMC-03411(E))
(Rept.-65-6; AD-623513) CFSTI: HC $3.00/MF $0.75

A ruby laser system has been assembled which includes provision for thermally tuning the laser operating wavelength. Experiments have been carried out which were designed to test the potential of such a radar for the remote determination of the vertical profile of water vapor by means of spectral study of the back scattered energy. The results of the experiments indicate that such measurements are feasible. However, detailed information must be obtained on the water vapor absorption line structure. A theoretical study has been undertaken of the contribution of secondary molecular scattering to the return observed by a laser optical radar. The results are presented as a function of the beam width of the receiver optics and the wavelength of the laser. It is shown that the contribution of secondary scatter to the observed energy can be made negligibly small by suitably restricting the beam width of the receiver optics. Author (TAB)

N66-14858# Texas Instruments, Inc., Dallas.
LARGE-ANGLE DEFLECTION TECHNIQUES FOR LASER DISPLAY First Quarterly Report
G. R. Fournier and H. W. Parker Griffiss AFB, N. Y., RADC, Nov. 1965 36 p
(Contract AF 30(602)-3731)
(U1-912008-1; RADC-TR-65-349; AD-624099) CFSTI: HC $2.00/MF $0.50

A large angle deflection technique for producing a 945-line T.V. type raster scan in an experimental laser display was developed, since conventional deflection methods could not be used. The horizontal scanner was comprised of a rotating mirror and a piezoelectric cartridge, coupled by a glass resonator shaft. A circular scan was generated and then transformed into a linear scan by a fiber optic converter. The use of the fiber optic bundle allowed zero flyback time. The linear beam was then deflected vertically by a galvanometer driven mirror at a 60 cycle per second rate. After vertical scanning, the light beam was projected through a lens on a screen. Circuitry for error sensing feedback for the scanners is continuing under study. Author (TAB)

N66-15048# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO. 261
14 Dec. 1965 18 p refs Transl. into ENGLISH from Chinese periodicals
(JPRS-33323; TT-65-33898) CFSTI: $1.00

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1. ON THE PHENOMENA OF MICROWAVE MASER BY LASER PUMPING W.-h. Huang, H.-y. Hsieh, Y.-s. Weing, and F.-c. Lin p 1–7 refs (See N66-15049 05-16)
2. THE FORMATION TIME OF OPTICAL OSCILLATION OF LASER H.-m. Teng, J.-w. Wang, and C.-l. Hsia p 8–11 (See N66-15050 05-16)
3. ANNOTATED TABLE OF CONTENTS OF CHINESE COMMUNIST JOURNAL ON GEOGRAPHY p 12–15

N66-15049 Joint Publications Research Service, Washington, D. C.
ON THE PHENOMENA OF MICROWAVE MASER BY LASER PUMPING
Wu-han Huang, Hsiang-yen Hsieh, Yuan-shu Weing, and Fu-cheng Lin *In its* Transl. on Communist China's Sci. and Tech. 14 Dec. 1965 7 p refs Transl. into ENGLISH from K'o-hsueh T'ung Pao (Peking), no. 10, Oct. 1965 p 929–931 (See N66-15048 05-16) CFSTI: $1.00

A dielectric coated ruby laser, working at the temperature of liquid nitrogen, was used to pump a ruby sample contained in a three centimeter microwave resonant cavity. Introduction of the laser light beam into the resonant cavity of the ruby sample changed the distribution of the resonant signal energy levels toward the microwave region. This indicated that the microwave cavity progressed from the original uncoupled state toward critical coupling. Subsequent heating and adjusting of the ruby in the microwave cavity led to a state of over-coupling and thus a microwave maser phenomenon was obtained. Front and rear of the downward portion of the maser were determined by the time characteristics of the laser pulse output. G.G.

N66-15050 Joint Publications Research Service, Washington, D. C.
THE FORMATION TIME OF OPTICAL OSCILLATION OF LASER
Hsi-ming Teng, Jun-wen Wang, and Cheng-li Hsia *In its* Transl. on Communist China's Sci. and Tech. 14 Dec. 1965 4 p Transl. into ENGLISH from K'o-Hsueh T-ung Pao (Peking), no. 10, Oct. 1965 p 931–932 (See N66-15048 05-16) CFSTI: $1.00

A high speed rotating disk with equally spaced teeth around its edge was placed into a low temperature helium–neon laser cavity of known output and dimensions. The laser output signal was sent through the gaps in the disk, received by a photomultiplier and displayed on an oscilloscope. An increase of the rotating disk speed reduced the output signal width correspondingly. Measurements of the rotation speed versus number of rotations at various frequencies were used to obtain the laser oscillation formation time. G.G.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N66-14403# United Kingdom Atomic Energy Authority, Harwell (England). Research Group.
DIFFUSION AND THERMODYNAMIC CHARACTERISTICS OF NICKEL–CHROMIUM ALLOYS
G. B. Federov, E. A. Smirnov, and F. I. Zhomov London, HMSO, Mar. 1965 13 p refs Transl. into ENGLISH from Met. i Metalloved. Chistykh Metallov (Moscow), v. 4, 1963 p 110–121 (AERE-TRANS-1031) HMSO: 2s 6d

The diffusion of chromium in nickel–chromium alloys was studied with the aid of radioactive isotopes. It was shown that alloying with chromium increases the activation energy of diffusion of chromium and reduces the diffusion coefficients in the temperature region below 1150° C. Investigation of the diffusion of nickel in the same alloys showed that increase in chromium content leads to reduction in the activation energy of diffusion and to an increase in the diffusion coefficients at temperature below 950° C. The nickel vapor pressure above the alloys as a function of temperature was determined. The partial vapor pressure and the thermodynamic activities of chromium in nickel–chromium alloys were determined at 1387° C. R.W.H.

N66-14429# David Taylor Model Basin, Washington, D. C.
MATERIALS SURVEY FOR THE RESCUE AND SEARCH VEHICLES OF THE DEEP-SUBMERGENCE SYSTEMS PROJECT
Abner R. Willner and Marcel L. Salive Mar. 1965 46 p refs (DTMB-1987; AD-614421) CFSTI: HC $2.00/MF $0.50

Factors influencing the selection of materials for the pressure hulls of vehicles for the Deep Submergence Systems Project are presented. Aluminum, steels, and titanium are discussed with respect to such properties as chemistry, strength, fatigue, toughness, and corrosion. The suitability of these materials from a fabrication standpoint is also explored. It is concluded that 721-titanium alloy appears to be the best candidate for the pressure hulls of deep-submergence vehicles where high-strength low-weight characteristics are required.
Author (TAB)

N66-14459# McGill Univ., Montreal (Quebec). Eaton Electronics Research Lab.
HIGH MAGNETIC FIELD SUSCEPTIBILITY OF CHROMIUM
Richard Stevenson Nov. 1965 3 p refs
(Contract Nonr-3013(00))
(AD-623571) CFSTI: HC $1.00/MF $0.50

The magnetic susceptibility of chromium metal has been measured in pulsed fields up to 400 koer. Decreases in the susceptibility are observed at about 270 koer and 330 koer.
Author (TAB)

N66-14490# Commisseriat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires
STUDY OF U–Pu–Fe ALLOYS (MASURCA CRITICAL EXPERIMENT) [ETUDES D'ALLIAGES U–Pu–Fe (EXPERIENCE CRITIQUE MASURCA)]
Pierre Barthelemy and Rene Boucher Brussels, EURATOM, Oct. 1965 47 p refs In FRENCH; ENGLISH summary
(Contract EURATOM-006-62-1 RAAF)
(CEA-R-2792; EUR-2449.f) CFSTI: HC $2.00/MF $0.50

Three compositions of U–Pu–Fe alloys were studied. After two weeks in air 74.5 U–25 Pu–0.5 Fe alloys were reduced in powder. As-cast alloys containing 1 and 1.5% Fe were kept undamaged for several months. However, a rapid oxidization of the alloys was observed when the samples underwent phase transformation (at 595 and 590° C, respectively). Ignition tests in the presence of air showed that the oxidization starts at about 250° C and does not spread. Ignition was not observed during heating from 20 to 660° C. The transformation temperature, melting temperature, and thermal expansion coefficients were determined by dilatometry. Below the transformation temperature, the principal phases are U–Pu$_\zeta$ and (U, Pu)$_6$Fe. Thermal conductivity, Young modulus, density, and heat of fusion were also measured. Compatibility tests showed that between U–Pu–Fe and stainless steel a phase of (U, Pu)$_6$Fe type is formed. The 74 U–25 Pu–1% Fe alloy seems to behave better than 73.5 U–25 Pu–1.5% Fe alloy because the (U,Pu)$_6$Fe layer is two or three times smaller. Finally, thermal stability was studied with the 74 U–25 Pu–1% Fe alloy. A dilatometric anomaly (very weak expansion) occurred when the sample was heated above transformation temperature and cooled. NSA

N66-14534# Naval Research Lab., Washington, D. C.
CONDITIONS OF FAILURE IN FATIGUE CRACKED 4340 STEEL
E. P. Klier 7 Oct. 1965 14 p refs
(NRL-6317; AD-623566) CFSTI: HC $1.00/MF $0.50

For a fatigue-cracked tension specimen, the conditions of plastic failure, i.e., the stress conditions under which the section under the notch becomes plastic, have been developed by Hill. The analysis assumes the material to be ideally plastic, but, nonetheless, should be adequately approximate for heat-treated 4340 steel. Tension tests have been completed, and the results have been used to predict the notch strength for 4340 steel heat-treated to strength levels characteristic for this steel. The calculated notch strengths have been compared with the notch strengths which were earlier measured and reported. For limited conditions the calculated and measured values are found to be in adequate agreement. Differences in the calculated and measured values in the plastic failure interval can be attributed to the strain-hardening to which the 4340 steel is subject. The conventional tensile properties of 4340 steel at the several strength levels examined agree with the data in the literature except that the ductility is reduced. The true-stress natural-strain data indicate a transition in the strain-hardening exponent (n) from high to low values as the tensile strength increases from the minimum to the maximum values measured. TAB

N66-14548# Martin Co., Orlando, Fla. Materials Research Lab.
X-RAY STUDY OF WIRE-DRAWN NIOBIUM AND TANTALUM Technical Report No. 12
R. P. I. Adler and H. M. Otte Sep. 1965 31 p refs
(Contract Nonr-3706(00))
(OR-6752; AD-623399) CFSTI: HC $2.00/MF $0.50

Deformation, introduced into Niobium (Nb) and Tantalum (Ta) specimens by wire drawing at room temperature, produced changes in the shape and position of X-ray diffraction peaks. The resultant peak profiles and locations of all available peaks were recorded using the Debye–Scherrer geometry on a modified diffractometer with crystal monochromated CuK α_1 radiation. The amount of deformation in the surface layers of both metals was found to saturate essentially after only 20 percent reduction in area. The measured decrease in the lattice parameters of either material was attributed to a residual surface stress; the average value for the deformed saturated state for both Ta and Nb wires corresponded to an equivalent longitudinal tensile stress of 34 ± 5 kg. per sq. mm. Integral breadth measurements revealed approximately equal X-ray particle sizes in the <100> and <110> directions; the minimum particle size for the microstructures of both metals was around 200A and occurred after the first few draws. Author (TAB)

N66-14602# Illinois Univ., Urbana. Dept. of Civil Engineering.
THE EFFECT OF PLASTIC PRESTRAINS ON THE LOW CYCLE FATIGUE BEHAVIOR OF TITANIUM
J. B. Radziminski and W. H. Munse Aug. 1965 139 p refs *Its* Struct. Res. Ser. 294

An evaluation of the influence of large plastic prestrains, both tensile and compressive, on the room temperature static tensile ductility and low cycle fatigue resistance of a commercially pure titanium is presented. Fatigue failures at lives ranging from 1/4 to 10^3 cycles were examined. A number of polished hourglass-shaped specimens were tested to failure in static tension following the application of axial plastic precompressive strains of various magnitudes. The true fracture strain was found to decrease in direct proportion to the severity of precompression. The true tensile stress at fracture was not materially altered by the application of the prior compressive strain. Controlled strain axial fatigue tests were also conducted on specimens of the virgin titanium and on specimens initially subjected to two levels of plastic precompressive strain. The results of the fatigue tests revealed that, in the low cycle region, both tensile and compressive prestrains reduced the basic fatigue resistance of titanium. A good correlation was obtained between the proposed fatigue relationship and the titanium test results for each condition of prestrain and strain ratio examined. E.E.B.

N66-14615# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
IDENTIFICATION OF KINK BANDS IN PLASTICALLY DEFORMED LAMELLAR PEARLITE
M. Pröger Jun. 1965 10 p refs Transl. into ENGLISH from Prakt. Metallog. (W. Ger.), v. 1, no. 4, 1964 p 138–140
(AERE-TRANS-1035) HMSO: 1s 9d

By the plastic deformation of ferritic steels the lamellar pearlite deforms partially by forming kink bands. They can be demonstrated spatially on the surface of etched compression-test specimens after an additional deformation. The difference in orientation of the ferrite between band and matrix can be shown by a sodium picrate etching. Author

N66-14688# British Non-Ferrous Metals Research Association, London (England).
AGEING OF CHROMEL–ALUMEL THERMOCOUPLES
V. A. Callcut Risley, England, United Kingdom Atomic Energy Authority, 31 Aug. 1965 15 p refs
(TRG-1021(R/X)) CFSTI: HC $1.00/MF $0.50

Calibration changes in Chromel–Alumel thermocouples arising from aging drift, thermal cycling and depth of immersion are associated with a reversible change in the thermoelectric power of the Chromel leg which occurs on heating. Metallographic examination by optical, electron microscopic and thin-film transmission techniques have been used, but no evidence of chemical attack or precipitation has been found. It is concluded that the change in thermoelectric power is produced by ordering effects which occur in a range of nickel-chromium alloys, and hence cannot be eliminated by special preparation or by small changes in the alloy composition. Author

N66-14700# Library of Congress, Washington, D. C. Aerospace Technology Div.
HIGH-PURITY METALS Surveys of Soviet Scientific and Technical Literature; Annotated Bibliography, 1959–1963
Alex Zurichenko 8 Dec. 1965 29 p refs
(ATD-65-109)

An annotated bibliography of Soviet and Soviet-bloc materials dealing with high purity metals is presented. All of the articles included are cataloged at the Library of Congress Aerospace Technology Division, from which information about availability of translations can be obtained. M.W.R.

N66-14712*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INFLUENCE OF PROGRAMING TECHNIQUES AND OF VARYING LIMIT LOAD FACTORS ON MANEUVER LOAD FATIGUE TEST RESULTS
Patrick L. Corbin and Eugene C. Naumann Washington, NASA, Jan. 1966 21 p refs
(NASA-TN-D-3149) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Variable-amplitude axial-load fatigue tests were conducted on aluminum-alloy edge-notched specimens having a theoretical elastic stress concentration factor of 4. The load programs were designed to approximate maneuver load spectra. Fatigue life was found to be shorter for random form tests than for

block form tests having the same load spectrum. The greatest change in life occurred when the test program contained negative loads. Life for variable-amplitude tests was found to increase as much as 60 percent above the original test life after preloading with a program having a higher limit load factor. The summations of cycle ratios were approximately 2 for tests without negative loads but were approximately 1 for tests with negative loads. Author

N66-14742# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEM OF ALLOYING HEAT RESISTANT NICKEL BASE ALLOYS
V. G. Khoroshaylov 24 Sep. 1965 19 p Transl. into ENGLISH from Tr. Leningr. Politekhn. Inst. (Moscow), no. 234, 1964 p 89–95
(FTD-TT-65-650/1+2+4; AD-622468) CFSTI: HC $1.00/MF $0.50

Investigations made during the development of iron, nickel and cobalt base heat resistant alloys established that heat resistant properties of alloys are determined: (1) by the nature of the solid solution, its crystalline structure; (2) by the degree of alloying with rock-phobic and rockphilic elements, which raise the recrystallization point and hinder the diffusion processes; (3) by the degree of alloying with surface-active elements; (4) by the degree of alloying with elements, forming reinforcers; (5) by the nature of the reinforcing phase. TAB

N66-14754*# General Electric Co., Cincinnati, Ohio. Space Power and Propulsion Section.
STUDIES OF ALKALI METAL CORROSION ON MATERIALS FOR ADVANCED SPACE POWER SYSTEMS Quarterly Progress Report No. 5, Jun. 26–Sep. 26, 1965
R. W. Harrison [1965] 25 p refs
(Contract NAS3-6012)
(NASA-CR-54844) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Two stress corrosion reflux capsule tests are reported for a niobium-base alloy, designated D-43, in potassium. The first test completed 1000 hours at 2100° F; was removed from the test facility; and drained of potassium, cleaned, and sectioned. Although there were spots in the liquid and condensing regions on the inner surface of the capsule, these locations were not associated with regions of high stress. Lower uniaxial creep strengths were obtained from capsule test data than were predicted by pretest and literature data. Equivalent uniaxial creep strains of 7.4% in the liquid region and 5.4% in the condensing region were calculated. The second reflux capsule test has logged 1600 hours at 2050° F, and is still in progress. M.W.R.

N66-14757*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF COLD REDUCTION AND THERMAL TREATMENT ON TENSILE PROPERTIES OF A NICKEL–2 PERCENT BERYLLIUM ALLOY AT CRYOGENIC TEMPERATURES
Thomas W. Orange Washington, NASA, Jan. 1966 19 p refs
(NASA-TN-D-3196) CFSTI: HC $1.00/MF $0.50 CSCL 11F

This investigation was conducted to determine the tensile properties of a precipitation-hardenable nickel–2% beryllium alloy (Berylco 440) in 0.020-inch-thick sheet form at temperatures from ambient to −423° F. The properties of this alloy over the range of commercially available conditions were determined, and the effects of extended aging times and temperatures as well as degrees of cold reduction greater than those commercially available were studied. Specimens parallel to the direction of rolling were tested at ambient temperature, −320° and −423° F. No transverse properties were determined. The alloy studied has high toughness and elongation at cryogenic temperatures in comparison with other high-strength materials. When cold-reduced 60% and aged, yield and notch strengths at −423° F were 267 and 219 ksi, respectively, and average elongation was 19%. Overaging appeared to be of no benefit since it reduced the −423° F ultimate and yield strengths without increasing the notch strength. Comparison of the limited data obtained in this investigation and elevated-temperature data from the alloy supplier indicate that this alloy would be usable at temperatures ranging from −423° to about 800° F. Author

N66-14785*# General Electric Co., Cincinnati, Ohio. Space Power and Propulsion Section.
POTASSIUM CORROSION TEST LOOP DEVELOPMENT Quarterly Progress Report No. 8, 15 Apr.–15 Jul. 1965
E. E. Hoffman, ed. 23 Nov. 1965 50 p refs
(Contract NAS3-2547)
(NASA-CR-54843) CFSTI: HC $3.00/MF $0.50 CSCL 11F

Development of a prototype corrosion test loop for the evaluation of refractory alloys in boiling and condensing potassium environments which simulate projected space electric power systems is reported. The prototype test consists of a two-loop Cb–1Zr facility; sodium will be heated by direct resistance in the primary loop and will be used in a heat exchanger to boil potassium in the secondary, corrosion test loop. Heat rejection for condensation in the secondary loop will be accomplished by radiation in a high-vacuum environment to the water cooled vacuum chamber. Purification of the alkali metals for the prototype loop was performed. Checkout tests of the prototype loop equipment and controls were conducted and calibration of system instrumentation was completed prior to increasing system temperatures and flows to the design conditions. The results of the 5000-hour, 2000° F refluxing potassium capsule test to determine the compatibility of Mo-TZM alloy in a Cb–1Zr container indicate that no significant corrosion problem exists in this system at temperatures equivalent to those planned for the prototype loop test. M.R.W.

N66-14868# Brush Beryllium Co., Cleveland, Ohio.
EFFECTS OF PURIFICATION, AGGLOMERATION AND HEAT TREATMENT ON THE PROPERTIES OF BERYLLIUM SINGLE CRYSTALS
A. J. Stonehouse, J. A. Carrabine, and W. W. Beaver [1964] 24 p refs Presented at the Intern. Conf. on Beryllium Met. and Technol., Philadelphia, Oct. 1964
(TR-372)

Results of a study undertaken to examine the fate of several of the major metallic impurities in the zone-melting process and to ascertain their role in determining the properties of the zone-melted beryllium single crystal are presented. Two methods for the preparation of beryllium single crystal are considered: a zone-refining technique and a zone-leveling process consisting of zone-melting passes as in zone refining, but with the direction of the pass being alternated. The investigation shows that significant basal glide strain may be accommodated by the beryllium crystal without fracture while still in a relatively impure state. Aluminum was found to be one of the impurity elements which restricts basal glide in normal purity materials while iron had little effect on basal capacity, but had a significant effect on the CRSS. The zone-leveling study indicates that the achievement of the proper distribution and agglomeration of impurities results in the introduction of significant capacity for basal glide without substantial decrease in the CRSS and without a deleterious increase in the anisotropy of the beryllium crystal. M.R.W.

N66-14870# Royal Aircraft Establishment, Farnborough (England).

THE NATURE OF THE SENSITIVITY OF TITANIUM TO STRESS CONCENTRATORS UNDER CYCLIC LOADS [O PRIRODE CHUVSTVITEL'NOSTI TITANA K KONTSENTRATORAM NAPRYAZHENII PRI TSIKLICHESKIKH NAGRUZKAKH]

L. K. Gordienko and V. S. Ivanova Sep. 1965 17 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk (Moscow), no. 3, 1958 p 121–125

(RAE-LIB-TRANS-1126) CFSTI: HC $1.00/MF $0.50

The predominant mode of deformation under cyclic loading is by twinning: failure occurred by cracking at twin boundaries at both low and high stress levels. The effect of surface finish on the S/N curve is discussed. Author

N66-14891 Library of Congress, Washington, D. C. Aerospace Technology Div.

THEORY OF OPTIMAL ALLOYING

Dimitri Vvedensky *In its* Foreign Sci. Bull., v. 1, no. 12 Dec. 1965 p 15–18 refs (See N66-14887 05-34)

Dr. A. P. Gulyayev, an outstanding Russian metallurgist, has proposed a theory of optimal alloying, according to which the maximum beneficial effect of alloying is reached at a certain content of alloying elements. Any further alloying is not only useless, but even harmful, since it has a negative effect on the characteristics it is expected to improve. Author

N66-14915*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.

EVALUATION OF REFRACTORY/AUSTENITIC BIMETAL COMBINATIONS First Quarterly Progress Report, 22 Jun.–22 Sep. 1965

J. L. Godshall and R. W. Buckman, Jr. [1965] 37 p refs (Contract NAS3-7634)

(NASA-CR-54834; WANL-PR(EE)-001) CFSTI: HC $2.00/MF $0.50 CSCL 11F

Sixteen refractory/austenitic bimetal combinations produced by explosive bonding were evaluated for bond integrity by ultrasonic resonance and dye penetrant techniques, metallographic examination, and reverse bend and tensile tests. Nine combinations were selected for complete evaluation of thermal stability. Equipment for diffusion annealing, high temperature thermal cycling and creep rupture determinations was procured and is being assembled. Author

N66-14950# Army Materials Research Agency, Watertown, Mass. Materials Engineering Div.

IMPACT PROPERTIES OF AIR- AND VACUUM-MELTED AISI 4340 STEEL

George E. Gazza and Frank R. Larson Sep. 1965 24 p

(AMRA-TR-65-22; AD-622782) CFSTI: HC $1.00/MF $0.50

Several commercial heats of air- and vacuum-melted AISI 4340 steel were investigated to determine their mechanical properties. Data were derived from Charpy impact tests and tensile tests. The effect of decreasing phosphorus and sulfur content is correlated with changes in impact energy at 100 percent fibrous fracture, mechanical anisotropy, and tensile properties. It is concluded that by reducing the phosphorus plus sulfur content to a maximum compositional limit of 0.020 weight percent, significant improvement in material toughness results and the degree of anisotropy is reduced. Author

N66-14997# Army Materials Research Agency, Watertown, Mass. Materials Engineering Div.

EFFECT OF MICROSTRUCTURE AND COOLING RATE ON THE MECHANICAL PROPERTIES OF Ti–6Al–6V–2Sn

Charles F. Hickey, Jr. Jul. 1965 20 p refs Presented at Ann. Meeting of Am. Soc. for Testing and Maters., Purdue Univ., Lafayette, Ind., 17 Jun. 1965

(AMRA-TR-65-16; AD-620746) CFSTI: HC $1.00/MF $0.50

The investigation concerns the separate effects of microstructure and cooling rate on the mechanical properties of the titanium alloy 6Al-6V-2Sn. Microstructure was varied by forging a 6-inch-diameter bar to diameters of 4-, 2-, and 5/8-inch. Each bar was then tested in both the annealed and heat-treated conditions. The effect of cooling rate alone was obtained by trepanning sections of 4-, 2-, and 5/8-inch diameter from the 6-inch-diameter bar, heat treating and testing. Mechanical property data were obtained utilizing tensile and impact specimens which were machined from the bar or section diameters following the final treatment phase. Photomicrographs are shown for a typical area of each condition. Results of the investigation show that working tends to refine the overall microstructure, whereas cooling rate is a determining factor on the structure of the matrix but has little or no effect on the primary alpha size. Both microstructure and cooling rate strongly influence the resultant mechanical properties of this alloy. Primary microstructure is the major contributing factor on ductility and impact while both primary microstructure and cooling rate influence the final strength properties. Author (TAB)

N66-14998# Atomic Energy of Canada, Ltd., Chalk River (Ontario).

A TECHNIQUE FOR LOW TEMPERATURE HYDRIDING OF ZIRCONIUM ALLOYS

E. E. Sexton Nov. 1965 17 p refs

(AECL-2511) CFSTI: HC $1.00/MF $0.50

A method of sample preparation was developed which would enable gaseous hydriding of zirconium alloys at temperatures of 500° C and below. This method was developed to accommodate a demand for the hydriding of cold-worked mechanical test specimens, where higher hydriding temperatures could not be used since annealing out of the cold work would have resulted. It was found that hydrogen could be introduced at temperatures as low as 280° C by vapor blasting the specimen prior to hydriding, followed by homogenizing. This report describes the technique and presents some typical results. Author

N66-15051# Watervliet Arsenal, N. Y. Benet R&E Labs.

STRESS-AGING: A NEW TREATMENT FOR ALLOYS. PART TWO: EFFECT ON STANDARD TENSILE PROPERTIES OF 4330 TYPE STEEL

R. H. Harrington Sep. 1964 58 p refs

(WVT-6424, Pt. 2; AD-609243) CFSTI: HC $3.00/MF $0.75

Stress-aging is a new treatment for alloys that results in improved strength properties with little, or no loss in ductility. Specific treatments result in (a) maximum proportional limit or elastic capacity, (b) maximum 0.1% offset yield strength or (c) best generally high properties. The proportional limit may be increased by 65,000 psi (above the initial tensile strength), the 0.1% offset yield strength may be increased by 30,000 psi, with elongation ranging from 8% to 14%, while reduction of area remains essentially constant (50–54%). Stress-aging raises 4330 steel into the lower range of ultra-high-strength steels. Author (TAB)

N66-15060*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
RESEARCH ON FIBER-REINFORCED COMPOSITES
J. Chorne, W. H. Sutton, A. Gatti, R. Mehan, H. Ranch et al May 1965 28 p refs Presented at Refractory Composites Working Group 10th Meeting, Georgia Inst. of Technol., Atlanta, 12–14 Apr. 1965
(Contracts NAS2-937; NOw-64-0540-c; DA-19-0660-AMC-184 (X); AF 33(615)-1696; AF 33(615)-1618 et al)
(NASA-CR-64087; R65SO18; AD-615662) CFSTI: HC $2.00/MF $0.50 CSCL 11D

The Space Sciences Laboratory of the General Electric Company has been conducting investigations on the preparation and properties of fibers and fibrous composites for more than five years. Much of the original effort was directed towards the growth and properties of whiskers (short, single crystal fibers) and towards the development of high strength metals reinforced with these whiskers. While these investigations are continuing, additional program shave been undertaken which include the preparation of high modulus continuous filaments, a study of the wetting and bonding of metals to (oxide) whiskers, the development of effective composite fabrication procedures, and the evaluation of composite properties in terms of their potential properties. This report briefly summarizes some of the current results of six programs, sponsored by government agencies, which are being conducted at the Metallurgy and Ceramics Research Operation of the Materials Sciences Section, Space Sciences Laboratory. Author (TAB)

N66-15079# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
INFLUENCE OF THE HEAT-TREATMENTS ON THE STRUCTURE OF URANIUM-RICH ALLOYS CONTAINING ZIRCONIUM
C. Fizotti and A. Masperoni Nov. 1964 18 p refs
(RT/MET(64)4) CFSTI: HC $1.00/MF $0.50

Uranium alloys containing up to 5 wt % zirconium were heat treated by step-annealing them in the binary phase fields of the system. Aging at 550° C for different periods of time up to 1000 hr was performed on some alloys continuously cooled from the γ phase. Investigations to confirm one of the already published constitutional diagrams for the uranium–zirconium system were also performed. Author (NSA)

N66-15087# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
ATMOSPHERIC CORROSION OF URANIUM-CARBON ALLOYS [CORROSION ATMOSPHERIQUE DES ALLIAGES URANIUM-CARBONE]
Piere Rousset and Andre Accary May 1965 47 p refs In FRENCH
(CEA-R-2732) CFSTI: HC $2.00/MF $0.50

The corrosion of uranium-carbon alloys having compositions close to that of the mono-carbide was studied. It is shown that the extent of the observed corrosion effects increases with the water vapor content of the surrounding gas, and it was concluded that the atmospheric corrosion of these alloys is due essentially to the humidity of the air, the effect of the oxygen being very slight at room temperature. Optimum conditions for preserving U-C alloys are either a vacuum or a perfectly dry argon atmosphere. The type of corrosion involved is one that cracks under stress and is transgranular (it can also be intergranular in the case of substoichiometric alloys). Two hypotheses for explaining this mechanism are proposed, one of which is illustrated by the existence, at the fissure interface, of corrosion products which can play the role of corners in the monocarbide grains. Author (NSA)

N66-15089# California Inst. of Tech., Pasadena. Keck (W. M.) Lab. of Engineering Materials.
BASAL DISLOCATION MOBILITY IN HIGH PURITY ZINC SINGLE CRYSTALS
K. H. Adams, T. Vreeland, Jr., and D. S. Wood Jun. 1965 78 p refs *Its* AEC Res. and Develop. Rept.-3
(Contract AT(04-3)-473)
(CALT-473-4) CFSTI: HC $3.00/MF $0.75

Experimental measurements of dislocation mobility and density, and the strain-rate sensitivity of the flow stress were made on 99.999 per cent pure zinc crystals. Dislocation mobility in the $<11\bar{2}0>$ {0001} basal slip system was measured by observing slip band growth produced by load pulses of controlled amplitude and duration. The results of the experimental measurements of dislocation mobility are discussed in relation to current theories. A comparison of the strain-rate sensitivity and mobility measurements shows that a significant change in the density of moving dislocations is associated with a change in strain-rate. A dislocation model is proposed to explain the observed strain-rate sensitivity. Author (NSA)

N66-15090# Atomic Energy Commission, Washington, D. C.
RESEARCH IN THE FIELD OF REFRACTORY AND HARD COMPOUNDS
G. A. Meyerson (1964) 27 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Neorgan. Materialy (Moscow), v. 1, 1965 p 16–28 Presented at Jun. 1964 Session of Dept. of Phys. Chem. and Technol. of Inorg. Mater., Acad. of Sci., USSR
(AEC-TR-6616) CFSTI: HC $2.00/MF $0.50

The production, properties, and uses of refractory carbides, nitrides, borides, silicides, and sulfides are discussed. From various examples cited of investigations in the field of refractory and hard compounds, it was concluded that possibilities exist for the production of the compounds in pure form and with exactly set composition and structure. NSA

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N66-14440# Texas Instruments, Inc., Dallas.
NEW HIGH TEMPERATURE INFRARED TRANSMITTING GLASSES Final Technical Summary Report, 1 May 1962–31 Jul. 1965
A. Ray Hilton 30 Sep. 1965 170 p refs
(Contract Nonr-3810(00); ARPA Order 289)
(TI-08-65-121; AD-623262) CFSTI: HC $5.00/MF $1.00

Results obtained in the qualitative evaluation of glasses from seven IVA-VA-VIA ternary systems as high temperature infrared window materials are given. Four-component glasses formed from two ternary systems were prepared and characterized. The pertinent physical and physical properties of non-oxide chalcogenide glasses are summarized. Several specific glass compositions were fabricated in large pieces so that their optical and related physical properties could be accurately measured. The properties of a glass are determined by their constituent elements. The ratios between the constituent elements, and thus the location of the glass-forming region, are found to depend on the binary compounds which form between the constituent elements. Author (TAB)

N66-14470# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.
FILAMENTOUS CARBON AND GRAPHITE Technical Report, Jul. 1964–Mar. 1965
D. L. Schmidt and H. T. Hawkins Aug. 1965 43 p refs
(AFML-TR-160; AD-623517) CFSTI: HC $2.00/MF $0.50

Constructive pyrolysis of fibered organic materials yields a corresponding carbon or graphite fibrous product which is flexible, thermally stable, non-melting, strong, lightweight, and chemically inert. These novel fibers have been used as reinforcing agents in structural, ablative, and pyrolyzed plastics, and the composites thereof exhibit a combination of properties not previously obtainable. Recent methods for improving fiber properties are given. These include both vat-dipping and pyrolytic vapor deposition techniques. Property data on improved fibers are also listed. Author (TAB)

N66-14520# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VAPORIZATION OF PURE-OXIDE CERAMICS AT HIGH TEMPERATURES
Ye. S. Lukin and D. N. Poluboyaninov 7 Oct. 1965 19 p refs Transl. into ENGLISH from Ogneupory (Moscow), v. 29, no. 9, 1964 p 418–424
(FTD-TT-65-934/1+2+4; AD-623208) CFSTI: HC $1.00/MF $0.50

A method of investigating vaporization was developed which allowed the study the behavior of widely applied oxide ceramics at temperatures up to 2300C in a vacuum and in helium. At such temperatures all oxides vaporize, but in different manners depending upon their nature and the test conditions. One should look for the causes of the different vaporization of oxides in the crystalline structure of the substance itself, because vaporization depends on the type of crystalline grid and its energy and, consequently, is determined by the strength of the bond between atoms or ions of the substance. Author (TAB)

N66-14531*# Mellon Inst., Pittsburgh, Pa.
EFFECT OF CROSSLINK DENSITY ON THE CREEP BEHAVIOR OF NATURAL RUBBER VULCANIZATES
Donald J. Plazek [1965] 37 p refs Presented at the 36th Ann. Meeting of the Soc. of Rheology, Cleveland, 25–27 Oct. 1965
(Grant NsG-147-61)
(NASA-CR-69096) CFSTI: HC $2.00/MF $0.50 CSCL 11J

Torsional creep measurements on four natural rubber vulcanizates, crosslinked to different degrees, were carried out in the temperature range −50° C to 90° C. This investigation complements the studies on identical samples of the stress relaxation behavior by Chasset and Thirion and of the dynamic mechanical response by Ferry, Mancke, Maekawa, Oyanagi, and Dickie. The creep measurements being reported are shown to be in agreement with the stress relaxation results. In addition to the usual temperature reduction, a superposed curve was obtained using the apparent molecular weight between crosslinks, M_c, as a reduction variable. The variation in viscoelastic response with crosslink density is interpreted as a restrictive action of the chemical crosslinks on the transient entanglement network. Author

N66-14589# Naval Research Lab., Washington, D. C.
FILAMENT-WINDING PLASTICS. PART 3: SOME EFFECTS OF CURING AGENT STRUCTURE UPON EPOXIDE PLASTIC PHYSICAL PROPERTIES Interim Report
J. R. Griffith 13 Sep. 1965 12 p refs
(NRL-6313; AD-622118) CFSTI: HC $1.00/MF $0.50

Plastics studies have attempted to relate the molecular structural characteristics of epoxide resins to tensile properties of the plastics obtained, with particular attention devoted to resin systems suitable for filament-winding applications. Recent work has been concerned with finding an amine curing agent which gives optimum properties to the epoxy component. Basic requirements are that it be a liquid or low-melting solid or be soluble in the epoxide and that the reaction rate between the epoxide and the curing agent be slow enough to permit proper winding. Because of their slower reaction rate with epoxides, aromatic amines have been found preferable to aliphatic or alicyclic ones. Except in the case of m-aminobenzyl amine, physical properties of the system are not improved by extension of aliphatic side chains from the phenyl ring of the curing agents, and tensile properties of the plastic are diminished as the number of methylene groups increases. Of the combinations studied, one of the most suitable resins for wet winding is the system of m-aminobenzyl amine and the diglycidyl ether of Bisphenol A, because of its high elongation. The cis-trans bis (2,3-epoxy cyclopentyl) ether/aminobenzyl amine system is probably the strongest plastic available for wet winding. Author (TAB)

N66-14680# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO. 268 (APPLICATION OF POLYSILOXANES IN ADHESIVES)
Tao-i Ch'en 21 Dec. 1965 38 p refs Transl. into ENGLISH from Hua-Hsueh T'ung-Pao (Peiping), no. 10, 14 Nov. 1965 p 24–34
(JPRS-33442; TT-65-34016) CFSTI: $2.00

A rapid survey is made of adhesives containing polysiloxanes; and a discussion is given, according to their properties, of the direction of future development in the field of high temperature structural adhesives. Consideration is given to the synthesis, structure, and properties of polysiloxanes; and various graphs and tables of their characteristics are included. Also considered are such areas as the heat elasticity of several polymer films, the stability of substituent alkyl groups in polysiloxanes, adhesives of pure silicone resins, and the synthesis of polysiloxanes containing polar substituents. C.T.C.

N66-14694# Walter Reed Army Inst. of Research, Washington, D. C.
TENSILE PROPERTIES OF ALPHA CYANOACRYLATE ADHESIVES
John W. Hodge, Jr. Aug. 1965 13 p refs
(TR-6515; AD-470312)

The tensile properties of a series of alpha cyanoacrylate adhesives were studied. It was found that aluminum to aluminum bond strength decreased as one goes up the homologous series from methyl to octyl. Prolonged immersion in water up to seven days had an insignificant effect on bond strength, whereas water at elevated temperatures tended to degrade the bond strength. Author (TAB)

N66-14706*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INVESTIGATION OF BONDED PLASTIC TAPE FOR LINING FILAMENT-WOUND FIBER-GLASS CRYOGENIC PROPELLANT TANKS
Robert W. Frischmuth, Jr. and Paul T. Hacker Washington, NASA, Jan. 1966 48 p refs
(NASA-TN-D-3206) CFSTI: HC $2.00/MF $0.50 CSCL 11I

The use of filament-wound fiber-glass liquid-hydrogen propellant tank structures should result in a considerable weight savings compared to conventional metal tanks providing that a suitable internal liner can be developed. This report investigates the use of plastic tape liners bonded to the inner surface of the filament-wound structure. The compatibility of liners, made of Teflon and Mylar tape, with respect to the filament-wound shell was studied experimentally using liquid hydrogen and theoretically using an analytical technique derived in this report. The investigation shows for bonded liners used at the temperature of liquid hydrogen (normal boiling point 20° K) that Teflon is incompatible with the filament-wound structure and Mylar is limited; upon tank pressurization, the Mylar liner will fail in tension before the burst pressure of the filament-wound structure is approached. Author

N66-14707*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INVESTIGATION OF THIN FILMS AS FLOATING LINERS FOR FIBER-GLASS CRYOGENIC PROPELLANT TANKS
Robert W. Frischmuth, Jr. Washington, NASA, Jan. 1966 31 p refs
(NASA-TN-D-3205) CFSTI: HC $1.00/MF $0.50 CSCL 11I

The use of filament-wound fiber-glass liquid-hydrogen propellant tank structures should result in a considerable weight savings providing that a suitable internal liner can be developed. This report investigates the use of free-floating liners. A theoretical analysis and experimental study on laminated Mylar, Teflon, and aluminum–Mylar liners showed that upon tank pressurization at liquid-hydrogen temperatures, plastic liners fabricated to the internal dimensions of the filament-wound structure would fail in tension before the burst pressure of the filament-wound shell was approached. The study showed that the available liner strain could be increased by making the liner oversized and allowing it to randomly wrinkle within the shell. Author

N66-14737# National Academy of Sciences—National Research Council, Washington, D. C. Prevention of Deterioration Center.
REINFORCED PLASTICS AND LAMINATES FOR HOT STRUCTURES (600 F AND ABOVE)
William A. Cosby and Hans Janecka Feb. 1964 24 p refs
(PDC-64-009; PDL-50534; AD-621547) CFSTI: HC$1.00/MF $0.50

A bibliography on heat and oxidation resistant rainforced plastics and laminates for long-time structural use at temperatures of 600 F and above consisting primarily of references which evaluate such material systems from a mechanical properties point of view. References which evaluate the electrical properties of the material systems selected for their structural applicability are included if the evaluations were made at temperatures greater than 600F. Selected documents on reinforcement fibers are included due to interest in finishes and processing conditions which aid in the retention of fiber strengths at high temperatures. The bibliography does not contain references which evaluate the ablative characteristics of the materials. TAB

N66-14908*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL INVESTIGATION OF GLASS FLAKES AS A LINER FOR FIBER-GLASS CRYOGENIC PROPELLANT TANKS
Robert W. Frischmuth, Jr. Washington, NASA, Jan. 1966 17 p refs
(NASA-TM-X-1193) CFSTI: HC $1.00/MF $0.50 CSCL 11B

A method of lining a fiber glass tank with several layers of small, overlapping flakes of glass, interspersed in a resin and oriented parallel to the wall of the fiber glass shell, is discussed. In the fabrication technique developed, flakes of uniform size that passed through a 1/2-inch mesh screen were used; a thin coat of resin was sprayed on the mandrel; and a layer of glass flake was applied using a flocking gun. Six glass flake layers were used in the liner, with each layer rolled to force out air and excess resin and to insure proper orientation of the flakes. The liner was partially cured before winding the fiber glass shell to prevent slippage of the flakes, and no mold release was used. The liquid hydrogen test facility and procedure are described. Results indicate that the glass flake liner is thermally compatible with the filament wound shell; however, leakage prevented testing at a pressure greater than 1 atmosphere and no conclusion could be reached concerning strain compatibility. Design details are also included on the mandrel, shell, and end fitting of the filament wound tank. M.G.J.

N66-14964*# Stanford Research Inst., Menlo Park, Calif.
A STUDY OF BONDING BETWEEN GLASS AND PLASTIC IN GLASS-REINFORCED PLASTICS: PHASE II Quarterly Progress Report No. VI, 1 May–31 Jul. 1965
David L. Chamberlain, Jr. 13 Oct. 1965 22 p refs *Its* Rept.-7 (Contract NASr-49(14))
(NASA-CR-69199) CFSTI: HC $1.00/MF $0.50 CSCL 11I

Surface-based silicon atoms were alkylated to produce Si–R groups for investigating direct bond formation between glass and plastic in glass-reinforced plastic materials. Peel tests were run on glass and silica rings that had been treated to produce n-butyl groups on the surface, and data are presented graphically in terms of peel force against time. In addition, contact angle measurements were made for a series of organic liquids in cleaned and on surface-treated glass microscope slides; dilatometric measurements were made on specimens of glass-filled silicone elastomer; and a procedure for determining carbon in steel was adapted to analysis for carbon compounds on glass surfaces. This method is basically satisfactory but further work is necessary to permit differentiation between carbon on the glass and carbon in the glass. L.S.

N66-15185# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
A THEORY OF SNOW FAILURE
G. E. H. Ballard and R. W. Mc Gaw Aug. 1965 18 p refs
(CRREL-RR-137; AD-624198) CFSTI: HC $1.00/MF $0.50

A failure theory for dry snow is based on the supposition that the nature of ice at the temperatures found in natural snow will cause stress concentration at a pore boundary to be minimized. External stresses will therefore tend to be uniformly distributed across constricted areas of solid substance. Failure is considered to occur when the available solid substance is stressed to its ultimate strength, taking into consideration the function of temperature and type of failure, i.e., tension, compression, or shear. TAB

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

19

N66-14411# Wisconsin Univ., Madison. Dept. of Statistics.
USE OF TRANSFORMATIONS ON PARAMETERS IN NON-LINEAR THEORY. II: MEASURES OF NON-LINEARITY AND TRANSFORMATIONS TO REDUCE NON-LINEARITY

Irwan Guttman and Duane A. Meeter Jul. 1964 45 p refs
(Contract Nonr-1202(17))
(TR-38; AD-623696) CFSTI: HC $2.00/MF $0.50

Non-linear least squares problems, and measures of non-linearity are discussed. Some measures of nonlinearity due to Beale (1960 are introduced), and the behavior of these measures is examined using certain specific examples. The effect of using transformations of parameters to reduce the nonlinearity measures is investigated. TAB

N66-14510# Princeton Univ., N. J. Dept. of Graphics and Engineering Drawing.
FOUR-DIMENSIONAL DESCRIPTIVE GEOMETRY PROPOSITION OF A PROBLEM
C. Ernesto S. Lindgren Jun. 1965 11 p ref
(TSS-1; AD-621291) CFSTI: HC $1.00/MF $0.50

The paper proposes the determination of the coordinates of the point of a plane, in a four-dimensional space, equidistant to three 3-D spaces of the system of reference for the Four-Dimensional Descriptive Geometry. Author (TAB)

N66-14511# Princeton Univ., N. J. Dept. of Graphics and Engineering Drawing.
FOUR-DIMENSIONAL DESCRIPTIVE GEOMETRY METRIC PROBLEMS: ANGLES—DESCRIPTIVE SOLUTION
C. Ernesto S. Lindgren May 1965 46 p refs
(TSS-6; AD-621290) CFSTI: HC $2.00/MF $0.50

The paper presents the descriptive geometry solution of the determination of the angles between geometric elements in a four-dimensional euclidean space. Incorporated in these solutions are the discussions of some problems of intersections between two geometric elements. These are: intersection of a line and a plane, belonging to the same 3-D space; intersection of two planes belonging to distinct 3-D spaces; intersection of a line and a 3-D space; intersection of a plane and a 3-D space. Author (TAB)

N66-14512# Princeton Univ., N. J. Dept. of Graphics and Engineering Drawing.
FOUR-DIMENSIONAL DESCRIPTIVE GEOMETRY METRIC PROBLEMS: DISTANCES
C. Ernesto S. Lindgren Jun. 1965 16 p
(TSS-8; AD-621292) CFSTI: HC $1.00/MF $0.50

The paper presents the determination, in orthographic projections, of the true length of the distance between two given geometric elements in a four-dimensional space. Author (TAB)

N66-14513# Princeton Univ., N. J. Dept. of Graphics and Engineering Drawing.
FOUR-DIMENSIONAL DESCRIPTIVE GEOMETRY ROTATION—DESCRIPTIVE SOLUTION
C. Ernesto S. Lindgren Mar. 1965 28 p refs
(TSS-3; AD-621287) CFSTI: HC $2.00/MF $0.50

The paper presents the solution, by descriptive geometry methods, of some of the problems in rotation. Related problems, such as the determination of the point of intersection of a line and a 3-D space, are also discussed. Author (TAB)

N66-14514# Princeton Univ., N. J. Dept. of Graphics and Engineering Drawing.
FOUR-DIMENSIONAL DESCRIPTIVE GEOMETRY PROPOSED PROBLEMS
C. Ernesto S. Lindgren Jul. 1965 8 p
(TSS-9; AD-621293) CFSTI: HC $1.00/MF $0.50

There are many concepts in Four-Dimensional Synthetic Geometry that should be analyzed under the light of the Four-Dimensional Descriptive Geometry. In this paper such analysis is suggested in the form of problem proposition. Author (TAB)

N66-14538# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
MINIMIZING FUNCTIONALS ON NORMED-LINEAR SPACES Mathematics Note No. 419
A. A. Goldstein (Washington Univ., Seattle) Aug. 1965 20 p refs
(Grant AF-AFOSR-937-65)
(DI-82-0459; AD-623675) CFSTI: HC $1.00/MF $0.50

Steepest descent and related topics are discussed. An example is given taken from a simple rendezvous problem in control theory. The problem is one of minimizing a norm on an affine subspace. The problem here is solved in the primal. Author (TAB)

N66-14546# RAND Corp., Santa Monica, Calif.
THE FITTING OF DATA BY LEAST SQUARES TO NON-LINEARLY PARAMETERIZED FUNCTIONS
R. J. Clasen Oct. 1965 19 p refs
(P-3252; AD-623281) CFSTI: HC $1.00/MF $0.50

An iterative method is described for fitting data to a general non-linearly parameterized function, and details the numerical procedure for fitting data to determine certain constants arising from a chemical equilibrium problem. Procedures similar to the method described have been used by many authors to solve various function-fitting problems. Author (TAB)

N66-14642# Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center.
COORDINATE SPACES AND INFINITE SYSTEMS OF LINEAR EQUATIONS, II
Yu. I. Gribanov 25 Feb. 1964 19 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mat. (Kazan), v. 32, no. 1, 1963 p 66–74
(RSIC-140; AD-432804) CFSTI: $1.60

The general form of linear operators in coordinate spaces is described, and proofs are offered for the theorems which are stated. Equations are also derived for the general properties of matrix operators in coordinate spaces, and tests for continuity of matrix operators in coordinate spaces are formulated. One general theorem is presented for conveniently finding concrete conditions for continuity and complete continuity of matrix operators on concrete coordinate spaces. M.G.J.

N66-14649# Johns Hopkins Univ., Baltimore, Md.
SMOOTH REGRESSION ANALYSIS
Geoffrey S. Watson [1964] 20 p refs
(Contract Nonr-4010(09))
(AD-467119)

Few would deny that the most powerful statistical tool is graph paper. When however there are many observations (and/or many variables) graphical procedures become tedious. It seems to the author that the most characteristic problem for statisticians at the moment is the development of methods for analysing the data poured out by electronic observing systems. The present paper gives a simple computer method for obtaining a 'graph' from a large number of observations. Author (TAB)

N66-14684# California Univ., Berkeley. Inst. of Engineering Research.
THE EFFECTS OF VERTICAL DENSITY GRADIENT ON A SPHERICAL EXPLOSION

Samuel S. C. Lee (Ph.D. Thesis) Aug. 1965 100 p refs
(Contract Nonr-222(79))
(AS-65-13; AD-471401)

The aim of this work is to investigate the initial behavior of a spherical explosion, surrounded by a medium with a vertical density gradient. Special emphasis is given to the effects of this density gradient on the shapes of the propagating shock wave and the contact surface; the flow field in the region between these surfaces is also considered. An idealized model of a finite source explosion, namely, the sudden expansion of a sphere of highly compressed gas initially at rest, is considered in the present analysis. The solutions show that conditions in the expansion zone are not affected by the non-uniformity of the surrounding medium (at least up to the first order) and the importance of the unsymmetrical effects is apparent only in the outer regions. Two cases were calculated, namely, the blast from a pressurized sphere of air in the atmosphere and an underwater explosion. The first case deals with the isothermal expansion of air released from a pressurized sphere at an altitude of 2000 feet with an initial pressure ratio of 22. For the underwater explosion, the contained sphere of gas is released from an initial pressure of 63 atmospheres at a depth of 500 feet below the ocean surface. Results in both cases show that, in general, a small density gradient in the outer medium can have a significant influence on the shape of the shock, the variation of shock strength along the shock, the shape of the gas bubble and intermediate flow field. Author (TAB)

N66-14696# Boeing Co., Seattle, Wash.
AN INTEGRAL METHOD FOR FINDING THE FREE CONVECTION FLOW OF A HEAT CONDUCTING LIQUID
F. Edward Ehlers Jul. 1964 18 p ref *Its* Mathematical Note No. 359

In order to study temperature rise due to liquid circulation in a pipe in connection with geysering in rocket liquid fuel systems, an approximate integral method is developed for solving the equation of circulatory flow in the pipe. The developed method yields a set of first order ordinary simultaneous differential equations which can be solved numerically by the Runge–Kutta method. Equations of motion for the liquid, boundary conditions, and velocity and temperature profiles are discussed. M.W.R.

N66-14699# Rochester Univ., N. Y. Dept. of Physics and Astronomy.
HIGHER ORDER POLES IN THE S MATRIX
C. R. Hagen 10 Nov. 1965 11 p refs Submitted for Publication
(Contract AT(30-1)-875)
(UR-875-107)

The question of the possible existence of multiple poles in the S-matrix is discussed. It is shown by means of a simple model that such poles are not generally incompatible with Lagrangian field theory and can only be excluded in axiomatic formulations by the assumption of a unique correspondence between stable particles and the poles of the S-matrix on the physical sheet. Author

N66-14710*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE GENERATION OF A RANDOM SAMPLE-COVARIANCE MATRIX
Alan H. Feiveson Washington, NASA, Jan. 1966 19 p refs
(NASA-TN-D-3207) CFSTI: HC $1.00/MF $0.50 CSCL 12A

Trajectory estimation simulation problems make desirable a rapid procedure for generating random sample-covariance matrices based on large numbers of observations. This paper first presents an algorithm for such a procedure and then shows its derivation from the Cochran–Fisher Theorem concerning quadratic forms. Finally, an example is given. Author

N66-14717# Wisconsin Univ., Madison. Mathematics Research Center.
ON ORTHOGONAL m-PODS ON A CONE
H. B. Mann Jun. 1965 14 p ref
(Contract DA-11-022-ORD-2059)
(MRC-575; AD-623742) CFSTI: HC $1.00/MF $0.50

An orthogonal m-pod is a set of m mutually orthogonal lines meeting at the origin. A cone $\left\{\sum_{i=1}^{n}\lambda_i x_i^2 = 0,\ \lambda_1 \geq \lambda_2 \ldots \geq \lambda_n\right.$ contains an orthogonal m pod if and only if

$$\sum_{i=1}^{n-m}\lambda_i \geq \sum_{i=1}^{n}\lambda_i \geq \sum_{i=m+1}^{n}\lambda_i.$$

If $\sum_{i=1}^{n}\lambda_i = 0$ then every orthogonal m pod on the cone $\sum_{i=1}^{n}\lambda_i x_i^2 = 0$ can be augmented to an orthogonal n pod on $\sum_{i=1}^{n}\lambda_i x_i^2 = 0$

A method is given by which such orthogonal m-pods can be computed explicitly. Author

N66-14731# Wisconsin Univ., Madison. Mathematics Research Center.
RECENT ADVANCES IN DIFFERENCE SETS
Henry B. Mann Jul. 1965 18 p refs
(Contract DA-11-022-ORD-2059)
(MRC-594; AD-623749) CFSTI: HC $1.00/MF $0.50

An enumeration of cyclic difference sets by Marshall Hall in 1956 left 12 cases undecided. During the last three years all 12 cases were disposed of. The present paper combines methods of Yamamoto and Turyn to present a result which disposes not only of Hall's 12 cases but also of many other cases including non cyclic ones. Some of the author's results on difference sets in elementary Abelian groups are also discussed. Author (TAB)

N66-14736# Parke Mathematical Labs., Inc., Carlisle, Mass.
MATHEMATICAL ASPECTS OF ANALYSIS OF VARIANCE AND ITS APPLICATION IN A STATISTICAL ANALYSIS OF MEASUREMENTS WITH MS-7 MASS SPECTROMETER Scientific Report No. 3
N. G. Parke, III May 1965 31 p *Its* Rept.-2419-SR-3
(Contract AF 19(628)-2419)
(AFCRL-65-478; AD-621752) CFSTI: HC $2.00/MF $0.50

An application of the Analysis of Variance to the evaluation of the effects of major controllable parameter in the use of an MS-7 Mass Spectrometer for the determination of amounts of impurities. Author (TAB)

N66-14738# American Meteorological Society, Boston, Mass.
NEW METHOD OF DETERMINING THE LIAPUNOV FUNCTIONS [NOVYI SPOSIB VYZNACHENIIA FUNKTSII LIAPUNOVA]

V. I. Antipenko Bedford, Mass., AFCRL, Sep. 1965 15 p refs Transl. into ENGLISH from Avtomatyka (Kiev), no. 2, 1964 p 71–75
(Contract AF 19(628)-3880)
(T-U-5; AD-621425) CFSTI: HC $1.00/MF $0.50

The proposed new method is one for determining the Liapunov functions in the more general form required for investigating the stability of nonlinear automatic systems. The distinctive feature of the system is that no limitations are imposed on the type of Liapunov functions, and the Liapunov function is found objectively by solving a system of differential equations. An algorithm is proposed for formulating theindicated differential equations. TAB

N66-14787# Mitre Corp., Bedford, Mass.
ON THE STRUCTURE AND THE HAUSDORFF DIMENSION OF THE SUPPORT OF A CLASS OF DISTRIBUTION FUNCTIONS INDUCED BY ERGODIC SEQUENCES
Harry Dym Oct. 1965 22 p refs
(Contract AF 19(628)-5165)
(ESD-TR-65-130; TM-04155; AD-623616) CFSTI: HC $1.00/MF $0.50

The distribution function of the random variable

$$Z = \sum_{i=1}^{\infty} X_i D^{-i}$$

when the random variables $X_1, X_2, \ldots$ form a stationary ergodic sequence and each X_1 takes on integer values running from 0 to D-1 is examined. It is shown that the distribution function will be either a step function, or a continuous and purely singular function, or else a linear function of its argument. The form of the distribution function is related to the entropy rate of the random sequence. This relationship and also the relationship of entropy rate to the concept of Hausdorff dimension are discussed. M.R.W.

N66-14792# California Univ., Berkeley. Operations Research Center.
AN EXTENSION OF GENERALIZED UPPER BOUNDED TECHNIQUES FOR LINEAR PROGRAMMING
R. N. Kaul Aug. 1965 35 p refs
(Grant NSF GP-4593; Contracts Nonr-222(83); DA-31-124-ARO-D-331)
(ORC-65-27; AD-623465) CFSTI: HC $2.00/MF $0.50

The paper by Dantzig and Wolfe (Decomposition Principle for Linear Programs) suggested the need for developing new techniques for solving linear programming problems with a special matrix structure. A number of techniques have appeared since then. In this report, an algorithm for solving a structured linear programming problem with a very large number of blocks is given. The main feature of the method as described in another work (Generalized Upper Bounding Techniques for Linear Programming, II) is to carry out the computation with the help of a smaller basis whose order is equal to the number of linking equations coupling together the various blocks. Author (TAB)

N66-14794# Army Electronics Labs., Fort Monmouth, N. J.
TABLES OF OFFSET CIRCLE PROBABILITIES FOR A NORMAL BIVARIATE ELLIPTICAL DISTRIBUTION
Erwin Biser and George Millman Aug. 1965 232 p refs
(ECOM-2625; AD-623882) CFSTI: HC $6.00/MF $1.25

This report consists of two major parts. The first deals with the development of formulas for computing the probability that a point taken from a normal bivariate elliptical distribution with specified mean and standard deviations shall fall within a circle of given radius whose center is displaced a given distance from the center of the distribution. The second part consists entirely of probability tables. These tables will prove especially useful in dealing with problems involving accuracy studies of weapons systems and with other problems notably in meteorological studies. The events in many practical probability problems are best described by a normal bivariate elliptical distribution with unequal standard deviations. For example, one may be confronted with the problem of evaluating the probability that a missile will hit a circle of a specified radius whose center (aim point) is displaced a given distance from the mean (of impact points) of a normal bivariate elliptical distribution. In this example the impact points are governed by a normal (Gaussian) bivariate elliptical density function; the mean of this distribution is not zero (i.e., the center of the distribution is not about the aim point). TAB

N66-14824*# Stanford Univ., Calif. Dept. of Statistics.
SEQUENTIAL RANKING PROCEDURES
Elias Alphonse Parent, Jr. 23 Apr. 1965 180 p refs
(Contract Nonr-225(53))
(NASA-CR-69225; TR-80; AD-614271) CFSTI: HC $3.00/MF $0.75 CSCL 12A

Let $X_1, X_2, \ldots$ be a sequence of random variables with continuous cumulative distribution functions. We define the sequential rank of X_n relative to $X_1, X_2, \ldots, X_n$ to be k if X_n is the *k*th smallest in the set $(X_1, X_2, \ldots, X_n)$. The set of sequential ranks $Z_1, Z_2, \ldots, Z_n$ so defined is compared to the ordinary ranks and it is shown that in the case where the basic variables $X_1, X_2, \ldots$ are independent and identically distributed the sequential ranks and ordinary ranks are equivalent, and moreover the sequential ranks are independent. An application of sequential ranking is given for the two sample nonparametric problem in the context of Wald's sequential analysis. Specifically the problem treated is where X_{2i-1} $i = 1, 2, \ldots$, are distributed according to F and X_{2i} $i = 1, 2, \ldots$ are distributed according to F^a $a > 0$. It is shown that the sequential probability ratio test based on the sequential ranks terminates with probability one. A sufficient condition on the distribution F of $X_1, X_2, \ldots$ is determined to ensure the independence of the signed sequential ranks. Distribution theory for signed sequential ranks is obtained for the case where X_i $1 \leq i \leq m$ are distributed according to F and X_i $m + 1 \leq i \leq N$ are distributed according to G. An application of signed sequential ranking to process control problems is given. Author

N66-14838# Wisconsin Univ., Madison. Mathematics Research Center.
E-TRANSFORMS (II)
F. M. Ragab Jul. 1965 30 p refs
(Contract DA-11-022-ORD-2059)
(MRC-579; AD-623746) CFSTI: HC $2.00/MF $0.50

A new class of integral transforms is established. Special choices of the parameters in this new transform pair lead in turn to the derivation of Kontorovich-Lebedev transforms, generalized Mehler transforms, and other new transforms. Author (TAB)

N66-14839# Wisconsin Univ., Madison. Mathematics Research Center.
SOME ABSOLUTELY CONTINUOUS OPERATORS II
P. A. Rejto Jul. 1965 75 p refs
(Contract DA-11-022-ORD-2059)
(MRC-582; AD-623767) CFSTI: HC $3.00/MF $0.75

Abstract conditions are formulated for the absolute continuity of the part of an operator over an interval. These conditions are verified, in particular, for a class of Schrodinger operators. Entering the two-body problem, this shows that the continuous part of these operators is absolutely continuous. Author (TAB)

N66-14840# Wisconsin Univ., Madison. Mathematics Research Center.
A NEW PROOF OF THE REDUCIBILITY OF APPELL'S HYPERGEOMETRIC FUNCTION OF TWO VARIABLES
F. M. Ragab Sep. 1965 9 p refs
(Contract DA-11-022-ORD-2059)
(MRC-588; AD-623744) CFSTI: HC $1.00/MF $0.50

A new proof is given for the reducible case of Appell's function. Author (TAB)

N66-14841# Wisconsin Univ., Madison. Mathematics Research Center.
EXPANSIONS OF KAMPE DE FERIET'S DOUBLE HYPERGEOMETRIC FUNCTION OF HIGHER ORDER
F. M. Ragab Sep. 1965 24 p refs
(Contract DA-11-022-ORD-2059)
(MRC-589; AD-623745) CFSTI: HC $1.00/MF $0.50

Expansions of Kampe de Feriet's double hypergeometric function of higher order (i.e., with more parameters) in two variables are obtained. By specializing the number of the parameters in this function, new and known expansions of the four double hypergeometric functions of two variables are deduced. Author (TAB)

N66-14912*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SIMULATION STUDY OF THE AMOUNT OF SENSITIVITY TEST DATA REQUIRED TO REJECT THE HYPOTHESIS OF NORMALITY WHEN THE SAMPLE POPULATION IS NONNORMAL
John B. Gayle and C. L. Hopkins 4 Nov. 1965 20 p refs
(NASA-TM-X-53357) CFSTI: HC $1.00/MF $0.50 CSCL 12B

Computer simulation techniques were used to study the number of sensitivity tests which are required to reject the hypothesis of a normally distributed sample population when the population actually was nonnormal. The results indicated that, even under the most favorable conditions, the number of tests required far exceed the number usually run in sensitivity type testing. This suggests that any assumption concerning the statistical nature of the distribution ordinarily will not be verified experimentally. Author

N66-14920# Parke Mathematical Labs., Inc., Carlisle, Mass.
ON THE THEORY OF BOOLEAN FORMULAS: ALLOWABLE REPLACEMENTS FOR SUBFORMULAS
E. W. Samson (AFCRL), and L. Calabi Bedford, Mass., AFCRL, Aug. 1965 35 p refs Prepared in cooperation with AFCRL *Its* Phys. and Mathematical Sci. Res. Paper No. 129
(Contracts AF 19(628)-2417; AF 19(628)-4790)
(AFCRL-65-640; AD-623921) CFSTI: HC $2.00/MF $0.50

The theory of substitutions for Boolean formulas developed in a previous report is applied here to the determination of those s-tuples of formulas that may be allowable replacements for s-tuples of subformulas of given Boolean formulas. The criteria of allowability are very general and flexible, yet may be expressed with great precision and ease. The results formalize and extend various known isolated instances. They may be used for the study of a large number of problems in the theory and application of Boolean formulas and functions. Author (TAB)

N66-14936# Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.
EXTENSIONS OF THE TWO-ARMED BANDIT AND RELATED PROCESSES WITH ON-LINE EXPERIMENTATION
Kent Quisel 15 Nov. 1965 106 p refs
(Contract Nonr-225(50))
(TR-137; AD-623884) CFSTI: HC $4.00/MF $0.75

Sequential decision problems are considered in which immediate payoffs are random with unknown means. Using prior knowledge, each decision is based on the prior expected payoff and the future value of information associated with the observed payoff. A fundamental theory is developed and used to extend the two-armed bandit model to multiple arms and setup costs or bonuses, assuming only two states of nature. Conjugate prior densities lead to a "stay-on-the-winner" rule for bounded variables. A least-squares policy iteration method is developed for computation. Bounds on the optimal return function are derived for general stochastic dynamic programming problems. Author (TAB)

N66-14978 Joint Publications Research Service, Washington, D. C.
ON A CLASS OF PROCESSES FOR MATRIX GAME SOLUTIONS
Ya. M. Likhterov *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 31-56 refs
(See N66-14976 05-10) CFSTI: $6.00

A computational procedure for solving a class of processes used in the solution of matrix games is discussed. The structure of the processes are described. The processes are of the type which converge incomparably rapidly, and among this class, the Brown process is included. Since the entire problem of linear programming can be reduced to a solution of a matrix game, the solutions to the investigated processes can be applied to solutions of linear programming problems. L.S.

N66-15047# Joint Publications Research Service, Washington, D. C.
ON AN ALGORITHM FOR THE SOLUTION OF PROBLEMS OF INTEGRAL LINEAR PROGRAMMING WITH BOOLEAN VARIABLES
Yu. Yu. Finkel'shteyn 28 Dec. 1965 11 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 164, no. 5, 1965 p 993-996
(JPRS-33498; TT-65-34072)

An algorithm for the solution of integral linear programming problems is presented and applied to conditions where the integral variables take the values 0 and 1. A method of cutting off with the help of Boolean variables is described. Finiteness of the algorithm is proven and estimates for the number of iterations are given. Example calculations for a class of problems for which the upper estimate of the number of iterations is essentially smaller than the volume of complete sorting are presented. G.G.

N66-15106# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ON SOME SELECTION AND RANKING PROCEDURES WITH APPLICATIONS TO MULTIVARIATE POPULATIONS
Shanti S. Gupta and William J. Studden Oct. 1965 22 p refs *Its* Mimeograph Series No. 58
(Contracts Nonr-1100(26); AF 33(657)-11737)
(Rept.-58; AD-623217) CFSTI: HC $1.00/MF $0.50

A problem of subset selection for parameters which are not necessarily scale or location parameters is considered. A general theorem dealing with the infimum of the probability of a correct

selection for parameters occurring in densities which are Poisson mixtures of arbitrary densities on the interval (0, infinity) is proved. This theorem is applied to obtain the minimum value of the probability of a correct selection in several cases where multivariate normal populations are ranked according to a given scalar quantity. TAB.

N66-15161# Wisconsin Univ., Madison. Mathematics Research Center.
INTEGRALS INVOLVING KAMPE DE FERIET'S DOUBLE HYPERGEOMETRIC FUNCTION OF HIGHER ORDER
F. M. Ragab Sep. 1965 32 p refs
(Contract DA-11-022-ORD-2059)
(MRC-TSR-599; AD-623750) Sep. 1965 32 p refs

Infinite integrals involving Kampe de Feriet's hypergeometric function of higher order are evaluated. Author (TAB)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N66-14348 Imperial Coll. of Science and Technology, London (England). Dept. of Meteorology.
RESEARCH ON CHARACTERISTICS AND EFFECTS OF SEVERE STORMS Annual Summary Report No. 1
Aug. 1965 167 p refs
(Grant AF-EOAR-64-60)
(AFCRL-65-770; AD-623663) CFSTI: HC $5.00/MF $1.00

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2. THE ANALYSIS OF ATMOSPHERIC MOTION SYSTEMS J. S. A. Green, F. H. Ludlam, and J. F. R. Mc Ilveen 90 p refs (See N66-14350 05-20)

N66-14349 Imperial Coll. of Science and Technology, London (England). Dept. of Meteorology.
LARGE-SCALE CONDITIONS FOR THE OCCURRENCE OF SEVERE LOCAL STORMS
T. N. Carlson and F. H. Ludlam *In its* Res. on Characteristics and Effects of Severe Storms Aug. 1965 p 1–74 refs (See N66-14348 05-20) CFSTI: HC $5.00/MF $1.00

The large-scale conditions under which severe local storms develop are examined, and the types of atmospheric convection in the troposphere which generate such storms are studied. These are identified as small-scale, intermediate-scale, large-scale, and cumulonimbus convections, and details are given on each, and on the stratification of the atmosphere associated with both small- and large-scale convections. Several detailed case studies were made, with isentropic charts showing the flow relative to a large scale motion system, assumed to be in a steady state, used as the analytical technique. Methods for determining the distribution of dry- and wet-bulb potential ground temperature are described. Results indicate that the occurrence of the most intense storms depends upon a combination of geographical and large scale atmospheric flow features. M.G.J.

N66-14350 Imperial Coll. of Science and Technology, London (England). Dept. of Meteorology.
THE ANALYSIS OF ATMOSPHERIC MOTION SYSTEMS
J. S. A. Green, F. H. Ludlam, and J. F. R. Mc Ilveen *In its* Res. on Characteristics and Effects of Severe Storms Aug. 1965 90 p refs (See N66-14348 05-20) CFSTI: HC $5.00/MF $1.00

A discussion is given of the justification and usefulness of analyzing isentropic charts observations of the flow relative to a mature large-scale motion system under the assumption that the system is in a steady state. It appears that trade wind air may rise over a front into a jet stream, and that by an extension of the parcel theory into three dimensions the speed of a jet stream may be related to an area on the aerological diagram. Author

N66-14357# Defence Research Board, Ottawa (Ontario). Directorate of Scientific Information Services.
THE FORECASTING OF THUNDER SHOWERS
M. T. Dmitriyev, Nov. 1965 4 p Transl. into ENGLISH from Priroda (Moscow), v. 7, 1965 p 65–66
(T-434-R) CFSTI: HC $1.00/MF $0.50

Short-term thunder shower forecasting based on analysis of air at ground level has been found to be reliable. The method involves measurement of ozone and nitrogen peroxide concentration, and forecasts are found to be more accurate when these concentrations are measured simultaneously. Parallel use of radar, optical, or meteorological data is suggested as a means of further improving prediction. A time record is illustrated for ozone and nitrogen peroxide concentrations, obtained with a mass spectrometer and an automatic electronic potentiometer, during the development of a thunderstorm. M.W.R.

N66-14392# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
RAPID EVALUATION OF THE STATISTICAL CHARACTERISTICS OF AN AIRCRAFT IN ATMOSPHERIC TURBULENCE [EVALUATION RAPIDE DES CARACTERISTIQUES STATISTIQUES DES FACTEURS DE CHARGE DUS A LA TURBULENCE]
Gabriel Coupry 1965 22 p refs In FRENCH Presented at the 6th European Aeron. Congr., Munich, 1–4 Sep. 1965
(TP-256(1965)) CFSTI: HC $1.00/MF $0.50

A method, which precisely determines the influence of the different parameters, is given for predicting aircraft response to atmospheric turbulence. Based on the equations of statistical mechanics, it binds, in an explicit fashion, the standard deviation for the acceleration of the center of gravity to the standard deviation for the component normal to the turbulence. Transl. by D.T.

N66-14394# Joint Publications Research Service, Washington, D. C.
SOME ASPECTS OF THE INTERPRETATION AND USE OF CLOUD DATA FROM METEOROLOGICAL SATELLITES
Sh. A. Musayelyan 20 Dec. 1965 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 163, no. 5, 11 Aug. 1965 p 1134–1137
(JPRS-33405; TT-65-33979) CFSTI: $1.00

A methodology for determining vertical currents by the distribution of cloud cover is used for calculating the vertical components of the velocity vortex according to photographic cloud cover data obtained from Tiros meteorological satellites. R.N.A.

N66-14396# Joint Publications Research Service, Washington, D. C.
STABILITY OF HOMOPHASE AEROSOLS AND ITS ARTIFICIAL REGULATION
A. G. Kachurin and V. G. Morachevskiy 23 Dec. 1965 42 p Transl. into ENGLISH of chapter 4 from the book "Kinetika Fazovykh Perekhodov Vody v Atmosfere" Leningrad, Leningrad State Univ., 1965 p 102–135
(JPRS-33463; TT-65-34037) CFSTI: $2.00

A discussion is presented on the stability and regulation of two homophase aerodispersed systems in the atmosphere. The first, related to the presence of well developed local thermal convection, is manifested in the form of cumulus clouds. The second, formed from the turbulent transfer of water vapor in the air layer situated below the level with a temperature inversion or from a sharp decrease in the heat content of a moist air mass, is manifested in the form of stratiform clouds or ground fog. A new approach to artificially modifying these homophase aerodispersed systems to bring about their dissipation or induce precipitation is discussed. The physiochemical properties of water solutions of several surface-active substances, such as tetrasubstituted ammonium compounds and alkyl benzene compounds, were investigated. These substances in water solution are capable of a rapid change of energy at phase discontinuity which lowers surface tension. The processes occurring in a monodisperse homophase system when modified by such surface-active substances are described. Results show that these substances can lead to the formation of precipitation. R.N.A.

N66-14405# France. Direction de la Meteorologie Nationale, Paris.
STUDY OF THE WIND AND DIURNAL BREEZE IN PARIS AT THE SUMMIT OF THE TOWER OF SAINT-JACQUES [ETUDE DU VENT ET DE LA "BRISE DIURNE" A PARIS AU SOMMET DE LA TOUR SAINT-JACQUES]
H. Grisollet (Obs. de Paris) Sep. 1965 32 p refs In FRENCH
Its Monographs-46 CFSTI: HC $1.00/MF $0.50

Based on the accumulation of 29224 observations of the wind taken in the center of Paris every three hours over the years 1951 through 1960, a study is made of wind and diurnal breeze conditions. Even though the number of observations is great, the results obtained are statistically insignificant to permit distinctions for each of the 16 wind directions during each of the 12 months of the year. Average seasonal and annual observations of the wind are examined as a function of direction and speed. Speed of wind is considered in terms of diurnal variations, and maximum daily and average seasonal speeds by direction. Comparison is made of wind speed measured from the tower of Saint-Jacques in Paris and at Montsouris, the latter at a much higher elevation. Intensity, average direction, and diurnal variation are given for average wind and diurnal breeze during winter and spring. Numerous tables summarize the findings. Transl. by M.W.R.

N66-14409# Travelers Research Center, Inc., Hartford, Conn.
A PHYSICAL LOW-CLOUD PREDICTION MODEL Final Report, Jan.–Aug. 1965
Joseph P. Gerrity Bedford, Mass., AFSC, Electron. Systems Div., Oct. 1965 143 p refs Prepared for United Aircraft Corp. (Contract AF 19(628)-3437)
(ESD-TR-65-476; AD-623461) CFSTI: HC $4.00/MF $1.00

Results of three 12-hour forecasts (for different synoptic situations), computed with the model, are presented. Equations for the contact layer were derived for the forced convection, free convection, and strong inversion regimes. The requirement for upper boundary conditions is reduced; only the geostrophic wind components and upper-level cloudiness are required from a free-air model. Empirical methods were developed for computing the instrument shelter level temperature and relative humidity. The eddy diffusion coefficient for heat and water is a function of the Richardson number throughout the boundary layer. The linear geostrophic wind shear within the boundary layer is computed from the predicted temperature. The model has not been thoroughly tested; preliminary results suggest that, given a careful analysis of routine observational data, this boundary layer model will serve operationally-meaningful diagnostic and predictive functions. The logic used in constructing the computer program for the model is presented. Author (TAB)

N66-14487# Joint Publications Research Service, Washington, D. C.
MESOMETEOROLOGY
N. I. Novozhilov 16 Dec. 1965 11 p ref Transl. into ENGLISH from Priroda (Moscow), no. 10, Oct. 1965 p 34–39
(JPRS-33336; TT-65-33911) CFSTI: $1.00

A discussion is presented of the basic problems in studying mesoscale processes which cause natural phenomena such as thunderstorms, cloudbursts, and squalls. Consideration is given to the structure of the sources, the role of the mesoprocesses, and the scales of atmospheric formations. A brief review is included for meso-analyses, and what can be shown by these evaluations. C.T.C.

N66-14555*# Florida State Univ., Tallahassee. Dept. of Meteorology.
A STUDY OF NON-DEEPENING TROPICAL DISTURBANCE
Joanne Malkus Simpson, Michael Garstang, Margaret Chaffee, and Joseph Levine Aug. 1965 61 p refs
(Grants NsG-481; DA-AMC-28-043-64-G5; Contract Cwb-10693)
(NASA-CR-69099; AD-470469) CFSTI: HC $3.00/MF $0.75 CSCL 04B

Data from an experimental region based upon six islands of the Windward Group in the West Indies, a research vessel in the tropical Atlantic, an instrumented research aircraft, and TIROS VI and VII are used to study the structure of a specific disturbance which moved through the observational network during 15 and 16 August, 1963. Despite the fact that an unusual variety and amount of data is available, difficulties are encountered when an attempt is made to establish the physical and dynamic characteristics of the flow field and the attendant cloud and rainfall patterns associated with this disturbance. Taken individually, each source of data is found to be either inadequate or, in the light of other information, perhaps even misleading. When all data sources are treated collectively a number of interesting features of the disturbance are illuminated. By a large, these results bear little resemblance to conventional tropical models such as the easterly wave or equatorial vortex. In fact, it is felt that this study demonstrates that a necessary prerequisite to any modeling is quantitative description from adequate and extensive correlated observations over a wide area and a deep layer. Lacking a continental sounding network in the tropics, the only avenue for progress would appear to be specifically designed experiments based upon a selected island network and incorporating joint aircraft, oceanographic and satellite programs. Author (TAB)

N66-14570# McGill Univ., Montreal (Quebec). Stormy Weather Group.
ALBERTA HAIL STUDIES, 1964 Scientific Report No. 8

J. Derome, R. H. Douglas, W. Hitschfeld, and M. Stauder Jul. 1965 83 p refs
(Contract AF 19(628)-249)
(MW-42; AFCRL-65-600; AD-622792) CFSTI: HC $3.00/MF $0.75

The three-dimensional patterns of the large-scale divergence and vertical motion over North America are derived at twelve-hour intervals for a one-week period beginning May 21, 1962. The distribution of severe storms in the central and eastern United States during that period is examined and related to the patterns of vertical motion. The mean profile of large-scale vertical motion near early-morning storms is compared with the near late-afternoon storms; the two profiles are found to be quite different. The morning storms correlate highly with the patterns of upward motion; the afternoon storms do not, presumably because other factors such as local heating are of comparable importance. Author (TAB)

N66-14606# Florida State Univ., Tallahassee. Dept. of Meteorology.
SATELLITE STUDY, TROPICAL NORTH ATLANTIC, 1963. PART I: SURFACE WIND ANALYSES, JULY 26–AUGUST 31 Final Report
C. I. Aspliden, G. A. Dean, and H. Landers Sep. 1965 23 p refs
(Grant WBG-32)

Presented are the surface wind analyses and the cyclone track charts which were accomplished initially without any reference to the satellite pictorial data. Subsequently, they were checked carefully with mosaics and nephanalyses of all of the Tiros VI and Tiros VII passes through the region during the period. There was an average of two to three passes per day. No existing cyclones were eliminated nor new ones inserted as a result of the satellite data. It is noted that the cyclones generally appeared within predominant cloud masses, or on the southern or northern edge of such masses and that the asymptotes of confluence frequently seemed to be associated with cloud lines or bands. E.E.B.

N66-14627*# South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
THE FLASHING BEHAVIOR OF THUNDERSTORMS
A. S. Dennis [1965] 10 p refs Presented at 244th Natl. Meeting of the Am. Meteorol. Soc. on Cloud Phys. and Severe Local Storms, Reno, Nevada, 18–22 Oct. 1965
(Contract NASr-49)
(NASA-CR-69112) CFSTI: HC $1.00/MF $0.50 CSCL 04B

The distribution in time of individual lightning flashes recorded visually during 20 storms in New Mexico and on 23-cm radar screens during several storms in the south-central United States has been analyzed. The logarithms of the intervals between flashes within a given storm are normally distributed with a standard deviation, σ, of approximately one natural-log unit. The available data do not reject the hypothesis that there are no statistically significant variations in σ among storms. The autocorrelation of the intervals between flashes in one storm is very small. The implications of these findings are briefly explored. Author

N66-14723# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.
MEASUREMENTS IN A THERMAL BOUNDARY LAYER
V. A. Sandborn, C. Y. Liu, and M. C. Tao [1965] 59 p refs
(Grant DA-AMC-28-043-64-G9)
(AD-623901) CFSTI: HC $3.00/MF $0.50

A problem encountered in the flow of atmospheric winds over the earth surface is that of cold air over a warm boundary. The study is a part of a long range program directed toward understanding such flows. An exploratory set of measurements in the boundary layer over a heated, smooth, flat plate are reported. The boundary wall was maintained at approximately 35° F and the free stream air temperature was approximately 40° F. The free stream velocity was 20 feet per second. Measurements of the mean temperature, density and velocity distributions are given in both tabular and graphic data. Data on the fluctuating temperature, longitudinal velocity and velocity temperature correlation are also presented. The data were taken as an exploratory study to first determine the magnitude of the mean and turbulent terms in the boundary layer. Secondly, the present experiment indicated the problems to be overcome in measuring the thermal boundary layer. The report is intended as a data report on the measurements. Author (TAB)

N66-14796# Air Force Cambridge Research Labs., Bedford, Mass. Meteorology Lab.
A FAMILY OUTBREAK OF SEVERE LOCAL STORMS—A COMPREHENSIVE STUDY OF THE STORMS IN OKLAHOMA ON 26 MAY 1963, PART I
Keith A. Browning, ed., and Tetsuya Fujita (Chicago Univ.) Sep. 1965 365 p refs *Its* Spec. Rept.-32
(AFCRL-65-695(I); AD-623787) CFSTI: HC $7.00/MF $1.75

This monograph is a case study of an outbreak of severe local storms that produced several tornadoes and extensive large hail in Oklahoma on 26 May 1963. Several authors have combined to describe the organization, structure, and evolution of these storms from a number of points of view. The storms are analyzed on four different size scales: (1) as products of their large-scale environment, (2) as members of a mesoscale system or family unit, (3) as individual evolving cells, and (4) as tornado and hail factories, with the emphasis on the tornadoes and the hailstones themselves. Data are obtained from conventional synoptic and mesosynoptic networks, visual and photographic observations, surface weather surveys, weather radars, sferics detectors, balloon tracks, radioactivity measurements in precipitation, and hailstone thin sections. Simple models are presented describing the airflow, structure and life cycle of individual severe local storms. Author (TAB)

N66-14844# Travelers Research Center, Inc., Hartford, Conn.
DATA PROCESSING PLANS FOR BALLISTIC WINDS STUDY Quarterly Report No. 1, 1 Jun.–31 Aug. 1965
Frederick P. Ostby, Jr. Ft. Monmouth, N. J., Army Electron. Command, Oct. 1965 14 p refs
(Contract DA-28-043-AMC-01377(E))
(ECOM-01377-1; AD-623836) CFSTI: HC $1.00/MF $0.50

Detailed computer program specifications were written for a preprocessor to perform various editing and minor calculating functions on a basic set of rawinsonde data. These functions are described. A formulation was made of the several parts of the Conditional Relaxation Analysis Method (CRAM) program that will be used to analyze the data. The procedures for the initial guess, correction, solution of Poisson's Equation by relaxation, and smoothing are discussed. Author (TAB)

N66-14881 Wisconsin Univ., Madison. Dept. of Meteorology.
THE ROLE OF LATENT AND SENSIBLE HEAT FOR THE DEVELOPMENT OF A HIGH PRESSURE SYSTEM OVER THE SUBTROPICAL ANDES, IN THE SUMMER
Gabriel Jules Gutman and Werner Schwerdtfeger *In its* Studies of Large Scale Atmospheric Energetics Jun. 1965 p 95–124 refs (See N66-14876 05-13)

The circulation over the Altiplano of Bolivia gives evidence of a high reaching anticyclone during the summer months, whereas in winter there is a straight West–East flow, at least in the layers between 500 and 100 mb. The wind and thermal wind over Antofagasta (West Coast of South America, at the Tropic of Capricorn) indicate that there must be a heat source to the East of the station, that is over the interior of the continent in the warm season, November through March. From an analysis of these winds and surface reports for the month of January, the vertical structure of the atmosphere over the Altiplano is derived, for conditions with and without thunderstorms. On this basis, the limits for the magnitude of the high pressure system can be established. TIROS II radiation data (8–12 microns) are used to illustrate the change of the cloud pattern over the area during the course of the day. A tentative heat budget of the region is calculated, leading to the conclusion that the high pressure system is maintained by the latent heat released in the violent thunderstorms which characterize the weather conditions of the Altiplano in summer, and to a lesser degree by the sensible heating of the atmosphere over the plateau. Author

N66-14918# Air Force Cambridge Research Labs., Bedford, Mass. Meteorology Lab.
SUMMARY OF ONE YEAR OF DATA FROM THE CAPE KENNEDY WIND SYSTEM
Joan Dwyer and Gordon L. Tucker Aug. 1965 88 p refs *Its* AF Surv. in Geophys., No. 169
(AFCRL-65-637; AD-623713) CFSTI: HC $3.00/MF $0.75

In July of 1962, an automatic computer-controlled meteorological data acquisition and processing system became operational at Cape Kennedy, Florida. One year of data from this Weather Information Network and Display (WIND) system has been edited. Selected parameters are presented in climatological summaries in this report. Author (TAB)

N66-14949# Illinois State Water Survey, Urbana. Meteorologic Lab.
INVESTIGATION OF THE QUANTITATIVE DETERMINATION OF POINT AND AREAL PRECIPITATION BY RADAR ECHO MEASUREMENTS Interim Report, 1 Oct. 1964–31 Mar. 1965
A. L. Sims, E. A. Mueller, and G. E. Stout [1965] 29 p refs
(Contract DA-28-043-AMC-00032(E))
(IR-1; AD-623409) CFSTI: HC $2.00/MF $0.50

The parameters of the log normal distribution are used to show the contributions to the rainfall rate of the number of drops, the width of the distribution, and the mode of the distribution. The progress of a statistical study of short period rainfall rates is reported. Drop break-up is investigated as an explanation for the large increase in the number of small drops for high rainfall rates in Miami. It is found to be an inadequate explanation. Some preliminary results of a study to determine an adequate sample size for drop-size studies are reported. Author (TAB)

N66-15013# American Meteorological Society, Boston, Mass.
THE STATISTICAL CHARACTERISTICS OF THE RADAR ECHO AS A FUNCTION OF THE DYNAMIC PROCESSES AND MICROSTRUCTURE OF THE METEOROLOGICAL ENTITY [SVIAZ' STATISTICHESKIKH KHARAKTERISTIK RADIOLOKATSIONNOGO SIGNALA S DINAMICHESKIMI PROTSESSAMI I MIKROSTRUKTUROI METEOOB"EKTA]
A. G. Gorelik, Iu. V. Mel'nichuk, and A. A. Chernikov Bedford, Mass. AFCRL, Aug. 1965 101 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 48, 1963 p 3–54
(Contract AF 19(628)-3880)

This article treats the development of a statistical radar method. It contains the entire theory of the method and indicates the possibilities of radar measurement of the wind speed and the microcharacteristics of precipitation. Mathematical formulas are given for using the spectrum of the radar echo to determine the average rate of power dissipation epsilon in turbulent flow, the wind shear, the hydrometeor size distribution, etc. The observational techniques and the apparatus are described. Observational data are presented for clouds of various types whose epsilon-values have been calculated. The paper also states the results of wind observations and indicates the feasibility of separating the directional pulsations of the wind from its velocity pulsations. The article contains the results of radar measurement of hydrometeor size distribution, precipitation intensity, etc. The lines of further development of statistical radar methods are noted. Author (TAB)

N66-15020# Air Force Cambridge Research Labs., Bedford, Mass. Aerospace Instrumentation Lab.
A CATALOGUE OF ARCAS-ROBIN SOUNDINGS
Robert W. Lenhard and Arthur J. Kantor Jun. 1965 25 p refs *Its* Environ. Res. Papers No. 113
(AFCRL-65-449; AD-622667) CFSTI: HC $1.00/MF $0.50

The data for 188 ARCAS-ROBIN rocket flights are described. Meteorological data for Holloman AFB in New Mexico, Wallops Station in Virginia, and Eglin AFB in Florida are available to a height of approximately 70 km for soundings taken between 11 October 1960 and 12 October 1962. Author (TAB)

N66-15057 Meteorological Office (Gt. Brit.)
ESTIMATION OF RAINFALL USING RADAR—A CRITICAL REVIEW
T. W. Harrold London, HMSO, 1965 59 p refs *Its* Sci. Paper No. 21
(Met.0.767) HMSO: 6s 6d

This paper considers the practical possibilities of the use of radar to determine the amount of water falling into a catchment during a given time period and in measuring precipitation over the sea. There are two basic methods of making quantitative radar rainfall measurements. One of these relates the intensity of the echo received from the rain to the rate of rainfall. If Plan Position Indicator (PPI) scanning is used and the signals can be integrated over an area and period of time then this method should provide measurement of a real rainfall. The alternative method depends on the fact that at certain wavelengths the attenuation of a radar signal as it passes through rain can be related to the mean rate of rainfall along the path. If the attenustion could be measured along several fairly closely spaced paths then it might be possible to estimate the rainfall over an area. This paper discusses the various factors which limit the accuracies of both these measurements and describes how a radar might be developed so as to register automatically the rainfall amount over a chosen area. N.E.A.

N66-15160# Honeywell, Inc., St. Paul, Minn. Research Dept.
CONTAMINATION EFFECTS IN STRATOSPHERIC HUMIDITY MEASUREMENTS Final Report, Jul. 1964–Jul. 1965
John G. Ballinger, Lyle E. Koehler, and Richard D. Murphy Aug. 1965 116 p refs *Its* Rept.-1551-FRI
(Contract AF 19(628)-3857)
(AFCRL-65-617; AD-623756) CFSTI: HC $4.00/MF $0.75

This report covers work done on solving some basic problems of stratospheric humidity measurements, in particular the contamination of the air sample by water vapor desorbed from

the flight vehicle and instrument package. Results of theoretical and experimental studies of frost-layer dynamics are presented and their implications for automatic frost-point hygrometers are discussed. Instruments used on the program are described, and data from three stratospheric balloon soundings are presented and analyzed from a contamination standpoint. An optimum water-vapor sounding technique is suggested, along with recommendations for further study. Author (TAB)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N66-14365# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Institut für Flugmechanik.

THEORETICAL INVESTIGATION ON THE GUIDANCE OF MISSILES INTO A MOVING LINE OF SIGHT SHORTLY AFTER LAUNCHING [THEORETISCHE UNTERSUCHUNG DES EINLENKENS EINES FLUGKORPERS AUF EINE BEWEGTE ZIELDECKUNGSGERADE KURZ NACH DEM START]

W. Duffek Sep. 1965 132 p refs In GERMAN; ENGLISH summary

(DLR-FB-65-41) CFSTI: HC $4.00/MF $1.00

It is shown that the best way for guidance in the launching phase is to generate the forces normal to the trajectory with the aid of thrust by rotating the missile. Angular accelerations result from deflecting the thrust jet. As this deflection is possible only up to a certain small angle, a very essential limitation enters the system. A nonlinear control system will be developed which carries out commanded rotations of the missile about a lateral axis in the shortest time possible. There will also be given a nonlinear guidance rule which makes the missile return from a misdistance to the line of sight within nearly shortest time, and following the movements of the line of sight. The efficiency of the control system for guidance in the launching phase will be illustrated by analog computer results. Only two-dimensional motions of missile and line of sight are considered. Author

N66-14391# Lear Siegler, Inc., Grand Rapids, Mich. Instrument Div.

HYPERBOLIC COORDINATE CONVERTER FLIGHT TEST EVALUATION

Donald Wozniak 30 Oct. 1964 79 p

(EMR-179)

This report contains a reduction of raw flight test data for evaluating the accuracy of hyperbolic to geographic coordinate conversion. A total of 22.9 actual flight time hours were logged for a flight from Grand Rapids, Michigan to Miami, Florida; Miami, Florida to San Juan, Puerto Rico; San Juan, Puerto Rico to Bermuda; and Bermuda to Washington, D.C. The accuracy of hyperbolic conversion is determined by taking the Loran C receiver time differences and computing the equivalent latitude and longitude coordinates using the U.S. Coast Guard equations on an IBM 1620 Computer. These outputs are then compared to the HCC outputs and histograms generated for distance difference, latitude difference, and longitude difference. Radar track information was not available at the time the main body of this report was written. This information has since been received and is included as an Addendum. This radar information accurately establishes the actual track flown, thus allowing accurate comparison between the HCC outputs and the actual track. Author

N66-14516# Cutler-Hammer, Inc., Deer Park, N. Y. Airborne Instruments Lab.

CAPACITY OF AIRPORT SYSTEMS IN METROPOLITAN AREAS: METHODOLOGY OF ANALYSIS Final Report

M. A. Warskow and I. S. Wisepart Jan. 1964 113 p refs (Contract FAA/BRD-403)

(AIL-1400-4; AD-623134) CFSTI: HC $4.00/MF $0.75

Since airports in metropolitan areas complement and interact with each other, they must be planned and operated as part of a system of airports. Furthermore, as air traffic continues to increase, more airports in metropolitan areas approach and reach capacity operation. Therefore, it is desirable to plan each airport in a metropolitan area as part of a system of airports in order to obtain the most efficient traffic flow, as well as the most efficient use of facilities. The operational factors involved in planning a system of airports in metropolitan areas are analyzed and used to determine the causes of congestion. Data obtained from previous studies is used to understand and demonstrate the operational factors and congestion. Airport congestion is defined in quantitative form for an individual airport and a system of airports. A methodology is presented that permits the many factors affecting the operation of an airport in a metropolitan system area to be evaluated quantitatively. The annual demand at which these airports will reach their practical annual capacity is determined by considering the effects of airport interactions and by determining quantitatively when congestion will occur at one airport and in the airport system. Author (TAB)

N66-14525# Cutler-Hammer, Inc., Deer Park, N. Y. Airborne Instruments Lab.

CAPACITY OF AIRPORT SYSTEMS IN METROPOLITAN AREAS: SUMMARY Final Report

M. A. Warskow and I. S. Wisepart Jan. 1964 42 p ref (Contract FAA/BRD-403)

(AIL-1400-3; AD-623102) CFSTI: HC $2.00/MF $0.50

Since airports in metropolitan areas complement and interact with each other, they must be planned and operated as part of a system of airports. Furthermore, as air traffic continues to increase, more airports in metropolitan areas approach and reach capacity operations. Therefore, it is desirable to plan each airport in a metropolitan area as a part of a system of airports in order to obtain the most efficient traffic flow, as well as the most efficient use of facilities. The operational factors involved in planning a system of airports in metropolitan areas are analyzed and used to determine the causes of congestion. Data obtained from previous studies is used to understand and demonstrate the operational factors and congestion. Airport congestion is defined in quantitative form for an individual airport and a system of airports. A methodology is presented that permits the many factors affecting the operation of an airport in a metropolitan system area to be evaluated quantitatively. The annual demand at which these airports will reach their practical annual capacity is determined by considering the effects of airport interactions and by determining quantitatively when congestion will occur at one airport and in the airport system. Author (TAB)

N66-14709*# McDonnell Aircraft Corp., St. Louis, Mo.

ORBITAL TESTING REQUIREMENTS FOR GUIDANCE AND CONTROL DEVICES, VOLUME II

F. Hercules and R. Butler Washington, NASA, Dec. 1965 396 p refs
(Contract NASw-1067)
(NASA-CR-356) CFSTI: HC $7.00/MF $2.00 CSCL 17G

Technical descriptions for thirty candidate orbital experiments of piggyback guidance and control devices are presented. Experiments are divided according to the needs for orbital testing, development status, and dependence on carrier vehicle design. Studies with devices that cannot adequately be ground tested include: electrostatic gyro, low-G accelerometer, gravity gradient sensors, earth horizon definitions, horizon sensor accuracy, gas bearings, and star characteristics. Experiments for the second group cover gravity gradient controls, ion attitude sensing, small impulse devices, optical mirrors and windows, etc. The last experiment category includes experiments on attitude control, master attitude reference, acquisition and tracking aids, time reference system, data handling system, command receiver, and electric power. All size, weight and power estimates for experiment equipment were based on available packaging information. G.G.

N66-14791# George Washington Univ., Washington, D. C. Human Resources Research Office.
THE EFFECTS OF MAP SCALE ON POSITION LOCATION
Ed Moon Edmonds and Robert A. Wright Sep. 1965 28 p refs
(Contract DA-44-188-ARO-2)
(TR-65-9; AD-623396) CFSTI: HC $2.00/MF $0.50

This study was conducted to determine the relationship between field position location and map scale. Two map scales were used—1:25 000 and 1:250 000. Twelve subjects were required to mark their position on a map at each of 12 terrain positions. The task was then repeated, utilizing the other scale map. The error in position location was approximately 10 times greater with the 1:250 000 scale map than with the 1:25 000 scale map. However, a significant scale-by-position interaction was found. It was concluded that maps of 1:100 000 or 1:125 000 scale would best meet the tactical target area requirements of Army aviators, and that the 1:250 000 scale map, with certain format changes, would provide the information necessary for en route tactical navigation over moderate or long distances. Author (TAB)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N66-14377*# National Aeronautics and Space Administration, Washington, D. C.
STUDY OF A NUCLEAR ELECTRIC GENERATOR FOR SPACE
Dec. 1965 46 p refs Transl. into ENGLISH of the publ. "Etude d'un Generateur Electrique Nucleaire Spatial" France, CEA, Feb. 1965
(NASA-TT-F-9806) CFSTI: HC $2.00/MF $0.50 CSCL 18N

The results of an exploratory study on selecting a nuclear electric generator for space applications are presented. Discussions are included on the electric power needs of space vehicles, the choice of the energy conversion process, the choice of the temperature range and materials, the reactor choice, control and starting problems, radiation protection, comparisons between the thermal and fast reactor, and examining the problem for different power levels. R.N.A.

N66-14492# Atomic Energy Establishment, Winfrith (England). Control and Instrumentation Div.
THE RESULTS OF THE RC10 IONISATION CHAMBER DEVELOPMENT
A. Goodings Mar. 1965 13 p ref
(AEEW-M-508) CFSTI: HC $1.00/MF $0.50

The present note sets down in an easily accessible form the main parameters of the design which was achieved. Appendix I gives sufficient information to permit a decision as to whether the new RC10 is likely to be useful for a given application. Theoretical derivations are shown where available so that the reliability of the experimental data can be assessed. In general it may be stated that the RC10 provides comparable nuclear performance to that of the well known RC7 with the added advantage of operating at temperatures up to 400° C. With the earlier chamber it is common practice to reduce the filling pressure when reduced sensitivity or improved neutron to gamma ratio is required. This cannot be done on the RC10 because pressures below about 1-1/2 atmospheres led to low maximum permitted currents and hence to a restricted working range. It is felt that filling pressure cannot be treated as a variable in this design and should normally be fixed at 2 atmospheres absolute. It may be noted that the design achieved is not completely optimized and possesses some flexibility. In particular it is thought that the insulation resistance may be increased in the future, and that some improvement in the residual current performance is possible. Author

N66-14505# Laboratoires du Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
SWELLING OF URANIUM Second Year of Study
S. Amelinckx, L. Stals, E. Ruedl (EURATOM), P. Delavignette, M. Goerge et al Brussels, EURATOM, Sep. 1965 44 p refs
(Contract EURATOM-187-62-4 RDB)
(EURAEC-1333; EUR-2310.e) CFSTI: HC $2.00/MF $0.50

The second year has completely been devoted to the electron microscope study of the dislocation structure in non-irradiated α-uranium foils and to the thermal neutron damage in α-uranium. The method of preparing uranium foils of about 20 μ thickness is described in detail. Use was made of such foils for the study of dislocations and radiation damage in α-uranium. In order to obtain transparent specimens to electrons the foils were finally thinned by electropolishing. The dissociation of dislocations into partials in α-uranium is definitely proved to occur by observation of extended and contracted nodes in twist boundaries. Numerous twins were also observed in the foils. The tops of the twins are sometimes fragmented and many dislocations are emitted from the noncoherent twin boundaries on the tips, thus enhancing the dislocation density within the grains. Features are also observed which are assumed to be stacking faults. Specimens irradiated at 80° C show all the same feature: rows of dislocation loops and black dots, lying along one of the principal axes of the crystal, whereas specimens irradiated at −195° C don't show this phenomenon. In this case, the defects are more randomly distributed, due to their lower mobility at low temperatures. A quantitative study of the number of defects as function of the diameter is made for specimens irradiated at −195° C. The formation of dislocation loops during irradiated may be responsible the the observed growth phenomenon of α-uranium. Author

N66-14579*# United Aircraft Corp., East Hartford, Conn. Research Labs.

THEORETICAL INVESTIGATION OF THE OPACITY OF HEAVY-ATOM GASES

N. L. Krascella Sep. 1965 60 p refs

(Contract NASw-847)

(NASA-CR-69001; D-910092-4) CFSTI: HC $3.00/MF $0.50 CSCL 18J

A theoretical investigation was conducted to determine the composition, spectral absorption coefficients and Rosseland mean opacity of gaseous nuclear fuel and tungsten using a semi-empirical heavy-atom analytical model in order to obtain information applicable to gaseous nuclear rockets. The characteristics of the nuclear fuel were determined for a range of values of each of the following parameters which must be assumed in using the heavy-atom model; ionization potentials, energy level spacings, total oscillator strengths, and the ratio of partition functions for successive ionization species. Included in these ranges of values were calculated ionization potentials and partition function ratios. The greatest changes in Rosseland mean opacity at a given pressure and temperature resulted from the calculated changes in fuel ionization potentials. The Rosseland mean opacity of gaseous tungsten was calculated on the basis of completely overlapped lines (which would result from line broadening due to the presence of a perturbing gas at indefinite pressure), and for finite-width spectral lines due to the presence of specified values of hydrogen partial pressure. Author

N66-14622# United Kingdom Atomic Energy Authority, Harwell (England). Electronics Div.

CALIBRATION OF THE NEUTRON SURVEY PROBE 95/0054

J. W. Leake London, HMSO, Jul. 1965 17 p refs

(AERE-M-1564) HMSO: 2s 6d

The neutron energy response of the survey probe 95/0054-1/6 was measured over a range of energies from thermal to 15 Mev. The response was shown to be substantially constant from thermal to 5 Mev, giving a neutron sensitivity of 0.6 ±60% cps/n/cm^2 · sec over this region. Author (NSA)

N66-14654# Picatinny Arsenal, Dover, N. J. Feltman Research Labs.

THE INFLUENCE OF GAMMA- AND X-RAY SCATTERING ON THE DESIGN OF SHIELDING

Aleksa Steiner Sep. 1965 27 p refs Transl. into ENGLISH from Elektrotekhn. (Yugoslavia), v. II, 1962 p 2129–2136

(PA-TM-1712; AD-472781)

In the design of shielding against Gamma- and X-rays in simpler cases encountered in practice, one often uses methods which are limited to the determination of the total attenuation and of the scattering effects. Such calculations use the so-called total attenuation coefficients and data which permit the numerical calculation of the scattering effects. While the application of attenuation coefficients is quite widespread and standardized, the calculation of scattering effects still follows very different paths. Recently, in simpler cases one often encounters certain auxiliary numerical factors (the so-called build-up factors) and the present article describes in particular the role of these factors. Author (TAB)

N66-14705*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RADIANT HEATING OF A SEEDED GAS IN A COAXIAL-FLOW GASEOUS REACTOR

Charles C. Masser Washington, NASA, Jan. 1966 29 p refs

(NASA-TN-D-3197) CFSTI: HC $1.00/MF $0.50 CSCL 18J

A theoretical analysis was made to determine how effectively a seed material can heat hydrogen propellant in a coaxial-flow gas-core reactor. It was assumed that the seed material was spherical and that the heat-transfer mechanism was radiation from the hot gas core to the spherical particles and conduction from the particles to the surrounding hydrogen gas. The following ranges of conditions were used: particle diameters from 0.05 to 1.00 micron; power outputs of the gas core from 3195 to 10097 megawatts per foot of core length, which correspond to surface blackbody temperatures of 30000° and 40000° R, respectively; constant density and specific heat corresponding to 500 atmospheres and 5500° R for the hydrogen propellant; and three values of hydrogen gas thermal conductivity corresponding to temperatures of 2900°, 5500°, and 8000° R. It is concluded that the difference between the particle and bulk gas temperatures can be kept under 500° R, and thus the propellant-seed mixture can be treated as a continuous gray gas. Several cases of high temperature differences of 1500° to 2000° R between the gas and the particles are computed, but these large temperature differences decrease quickly away from the heat flux source. Author

N66-14851# Naval Ordnance Lab., White Oak, Md. Air-Ground Explosions Div.

RESPONSE OF ENRICO FERMI REACTOR TO TNT SIMULATED NUCLEAR ACCIDENTS

Walter R. Wise, Jr., James F. Proctor, and Lloyd P. Walker Jan. 1965 183 p refs

(NOLTR-62-207; AD-610112) CFSTI: HC $5.00/MF $1.00

The MHA (maximum hypothetical nuclear accident) for the Fermi reactor has been postulated for the purpose of this report not to exceed in violence the detonation of 1000 pounds of TNT at the core location. This report is addressed to predicting the structural response of Fermi to the MHA, particularly the possible jump of the shield plug. An extensive experimental program was conducted in which scaled charges of explosives (some cased in molten sodium) were detonated in idealized models of the Fermi reactor. The results of this experimental program together with available theory indicate that the accident would be contained within the reactor shielding complex, but that the 143-ton shield plug, if unimpeded, might be propelled as high as 102 feet and through the roof of the containment building. In response to the findings of this extensive study, the Fermi reactor will be equipped with an arrester that will prevent a hazardous plug jump in the unlikely event of a nuclear accident. Author (TAB)

N66-14946 General Motors Corp., Indianapolis, Ind. Allison Div.

REACTOR PHYSICS CALCULATIONS FOR THE GASEOUS CORE CAVITY REACTOR

R. M. Kaufman, W. F. Osborn, Jr., and J. R. Simmons *In its* Allison Res. and Eng. 1965 p 11–18 ref (See N66-14944 05-34)

Calculations are presented for the effect of neutron absorption by a pressure vessel on the critical mass; temperature effects on fuel requirements with D_2O, BeO, and C reflectors; the effect of a D_2O layer between the fuel region and reflector; comparison of D_2O, BeO, and C reflectors; geometric effects such as length to diameter ratio; and the effect of confining the fuel to only portions of the cavity to provide indications of changes in critical mass and stability from a control standpoint. The calculations indicate that with plutonium fuel the critical mass of gaseous cavity nuclear rockets could be sufficiently small to be feasible from the standpoint of fuel inventory. The large reduction in critical mass of Pu with a C reflector when a small thickness of D_2O is included to make a composite reflector, indicates

that such a combination may be best from a cost and weight viewpoint. This result also stimulates interest in other applications for the gaseous cavity reactor concept including undersea or space power generators. E.E.B.

N66-15077# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.

DISC: A PROGRAM TO COMPUTE INELASTIC SCATTERING MATRICES FOR MULTIGROUP REACTOR CODES

C. R. Lubitz Aug. 1965 25 p refs
(Contract W-31-109-ENG-52)
(KAPL-M-6467) CFSTI: HC $1.00/MF $0.50

DISC is a Fortran program which constructs a multigroup transfer matrix from inelastic scattering data. It accepts data on the excitation of individual levels, if available, and augments this with an evaporation model to yield a desired total inelastic cross section. The level-inelastic or evaporation model calculations can also be run separately. The program will not handle anisotropic angular distributions and also neglects recoil of the target nucleus. Author (NSA)

N66-15085# Brookhaven National Lab., Upton, N. Y.

ALPHA GAMMA FACILITY FOR FUEL STUDIES

A. J. Banslaben and J. G. Y. Chow [1964] 12 p refs Presented at the 13th Conf. on Remote Systems Technol., Washington, D. C.
(Contract AT(30-2)-GEN-16)
(BNL-9450; CONF-651101-21) CFSTI: HC $1.00/MF $0.50

An alpha gamma facility was constructed at Brookhaven National Laboratory to study fast reactor fuel materials. The facility consists of three Argonne type DDD boxes, a welding dry box, and five shielded containment boxes. All the boxes will operate with a nitrogen gas atmosphere to avoid oxidation of fuel and to prevent NaK fire. In the design of the facility care was not used to duplicate functions for hot and cold testing of the fuel pellets. Author (NSA)

N66-15091# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.

SOSH-5; A COMPUTER PROGRAM FOR SHIELDING CALCULATIONS

M. S. Pendergast and G. O. Mueller 30 Jun. 1965 51 p refs
(Contract W-31-109-ENG-52)
(KAPL-M-6460) CFSTI: HC $2.00/MF $0.50

SOSH-5 is a computer program that can be used to calculate the neutron flux at a point P (e.g., an ion chamber) due to many neutron sources distributed so as to approximate a reactor core. The use of the program is mainly in relative matters rather than absolute quantities; i.e., determining the ion chamber sensitivity to water temperature, location of the ion chamber, location of the discrete neutron sources within the reactor, and the contribution to the ion chamber flux from various regions of the reactor core. SOSH-5 allows for fuel cells which are not parallel to the reactor centerline and for variable water density in the axial direction in the outer reflector. The program is capable of calculating the flux distribution along the centerline of the instrument tube for optimizing the location of the ion chamber. SOSH-5 is also capable of integrating the flux distribution over specified lengths of the instrument tube to yield a number proportional to the ion chamber response. Author (NSA)

N66-15094# Naval Radiological Defense Lab., San Francisco, Calif.

NEUTRON-FIELDS AND INDUCED ACTIVITY MEASUREMENTS

F. M. Tomnovec and J. M. Ferguson Sep. 1965 41 p refs
(CEX-62-50) CFSTI: HC $1.00/MF $0.50

Operation BREN (Bare Reactor Experiment, Nevada) was an experiment that used a 1500-ft tower and a bare (no shielding) fast nuclear reactor patterned on Godiva to simulate a nuclear weapon detonated at various heights above the ground. Certain characteristics of the neutron field from this unshielded reactor were measured. The activation of gold, manganese, sulfur, cadmium-covered gold, and cadmium-covered manganese was determined as a function of distance from the reactor and of depth in the ground. The data show how those parameters, important for calculating neutron-induced activity in the soil, vary as a function of the height of the source and the slant range from the source. Author (NSA)

N66-15127 Laboratoires du Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).

MEASUREMENTS IN A REACTOR BY MEANS OF A PULSED AND MODULATED SOURCE [MESURE AU MOYEN D'UNE SOURCE PULSEE ET MODULEE DANS UN REACTEUR]

W. Rotter 1965 34 p refs *In* FRENCH; ENGLISH summary Presented at the Colloq. Recherche au Moyen de Neutrons Pulses, Karlsruhe, W. Germany, 10–14 May 1965
(Contract EURATOM-006-60-5 BRAB)
(EUR-2513.f) CFSTI: HC $2.00/MF $0.50

A Philips generator the neutron flow of which is variable with any time function has evidenced its practical usefulness by a series of measurements carried out in the BR-2 reactor in the sub-critical state. Its good stability, combined with the possibility of abruptly varying the neutron intensity, pulsing the flow or modulating it sinusoidally, makes this generator a very flexible device. It can be used to determine the reactivity

$$(\varrho = \frac{\Delta k}{\beta k})$$

and the life of the neutrons (λ/β) by various independent methods. An accurate comparison of these methods is possible because they can be employed without modifying the measuring conditions. The author discusses the transfer functions for a reactivity oscillator and for a sinusoidally variable source. He shows that it is possible to measure the activity ϱ for $0.1\ \$ < \varrho < 10\ \$$ by using a modulated source. This method gives the reactivity by means of the prompt neutrons/delayed neutrons ratio for an optimum frequency, to all intents and purposes independently of the delayed-neutron data and the λ/β value. By a combination of the modulation and pulsing methods, the life of the prompt neutrons (λ/β) can be measured over a broad range in the sub-critical reactor. Author

N66-15148 Joint Publications Research Service, Washington, D. C.

ATOMIC ENERGY AS A POWER SOURCE

In its Transl. of Communist China's Sci. and Technol., No. 270 27 Dec. 1965 p 1–50 Transl. into ENGLISH from Yuan-Tsu-Neng Ti Yuan-Li Ho Ying-Yung (Peiping), Jul. 1965 p 133–179 (See N66-15147 05-22) CFSTI: $3.00

The application of atomic energy to power plants for civilian power use, for ships, for submarines, for rockets, and for other uses is discussed. Schematic diagrams of various types of atomic power plant installations, and of several types of cycling systems are depicted. An estimation of the cost of nuclear electric power is given, and technical problems relating to the construction materials, coolants, radiation protection, and automatic control of reactors are discussed. A general review of types of atomic power installations existing in the United States and the Soviet Union is given, along with schematic diagrams. L.S.

N66-15186*# Aerojet-General Corp., Azusa, Calif.
SNAP-8 MATERIALS REPORT FOR JULY–DECEMBER 1964
H. Derow and B. E. Farwell Jan. 1965 111 p refs *Its* Rept.-2989
(Contract NAS5-417)
(NASA-CR-54718) CFSTI: HC $4.00/MF $0.75 CSCL 18N

Progress is reported on the project to provide data to guide the selection of materials for SNAP-8 system components and of providing metallurgical assistance in the design, development, fabrication, and testing of that system. Among the work completed was the fabrication and testing of a prototype condenser tube-to-tube sheet joint sample representing the 0.5-inch-diameter tube end. Also, analytical methods were established for evaluating the lubricant-coolant fluid. These methods included gas chromatographic determination of isomer ratios and volatile impurities, halogen analysis, and phenol analysis. Creep rupture tests were conducted on welded and unwelded 9%Cr-1%Mo steel specimens to evaluate the gross creep rupture strength efficiency of welds. The tests were run at 1325° F at two stress levels, 1600 and 2300 psi. The results indicate that welding does not decrease the creep or creep rupture strength of this material at 1325° F. The assembly and installation of the CL-4 was completed during the period. The design and operating parameters of a hydrogen injector system for use in CL-4 were also completed. Flat sheet refractory bimetal tube material specimens were exposed to 1350° and 1450° F in a vacuum for 500, 1000, and 2500 hr to evaluate cross bond diffusion effects. E.E.B.

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N66-14356# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY NO. 257
9 Dec. 1965 34 p refs Transl. into ENGLISH from K'o Hsueh T'ung Pao (Peking), no. 10, Oct. 1965 p 853–861, 911–916, 925–926
(JPRS-33238; TT-65-33813) CFSTI: $2.00

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1. SYMMETRY, INTERNAL STRUCTURE, AND INTERREACTIONS OF FUNDAMENTAL PARTICLES Hu-Ning p 1–17 refs

2. DETERMINATION OF THE ABSOLUTE AGE OF ROCKS OF THE HSI-HSIA-PANG-MA PEAK REGION IN TIBET P'u Li, Tung-mo Tai, Mei-ying Chang, and A-shih Hung p 18–21

3. N,N'-DI-(2-HYDROXY-5-SULFOPHENYL)-C-CYANFORMAZAN AS A SPECTROPHOTOMETRIC INDICATOR FOR NIOBIUM Ju-ch'in Yü, Pai-chiu Li, and Chüeh-wu Chang p 22–24 refs

4. MICROANALYSIS OF ALDEHYDES AND AMINES Yao-tsu Ch'en and Chih-ch'ao Niu p 25–31 refs

N66-14408# Illinois Univ., Urbana. Dept. of Computer Science.
PATH INTEGRAL CALCULATION OF THE TWO-PARTICLE SLATER SUM FOR He_4
Lloyd D. Fosdick and Harry F. Jordan 20 Aug. 1965 45 p refs (Contract Nonr-183427)
(Rept.-186; AD-623398) CFSTI: HC $2.00/MF $0.50

The Wiener integral formulation combined with Monte Carlo sampling has been used to compute the two-particle Slater sum for He_4 for temperatures ranging from 273K down to 22K, the lower practical limit for this computational method. This is equivalent to a calculation of the density independent part of the pair distribution function. A Lennard-Jones 6–12 potential has been used to describe the interaction. Contributions from exchange were found negligible at 5K and above. Comparisons with the Wigner-Kirkwood expansion are made. The second virial coefficients derived from these results are within two per cent or three per cent of the results obtained from the usual phase shift calculation. Author (TAB)

N66-14433# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
A RAY-TRACKING PROGRAM FOR BIREFRINGENT FILTERS
J. M. Beckers and Richard B. Dunn Aug. 1965 40 p refs *Its* Instrumentation Papers No. 75
(AFCRL-65-605; AD-622563) CFSTI: HC $3.00/MF $0.50

A computer program for determining the transmission of birefringent filters is described. This program is used for the following investigations: (a) The feasibility of the construction of a birefringent filter that will work simultaneously for wavelengths of 3933.3, 6562.8, and 10830.3 Angstroms. These three wavelengths are of particular importance for solar studies; (b) the off-axis characteristics of Solc filters; (c) the tolerances required for the elements of a Solc filter; (d) the influence of imperfect polarizers on the transmission characteristics of Lyot filters. Author (TAB)

N66-14454# Stanford Univ., Calif.
MEASUREMENTS AT HIGH FIELD STRENGTHS ON SUPERCONDUCTING ACCELERATOR CAVITIES
H. A. Schwettman, P. B. Wilson, and G. Y. Churilov Jun. 1965 10 p refs Presented at the Vth Intern. Conf. on High Energy Accelerators, Frascati, Italy, Sep. 1965
(Contract Nonr-225(67))
(HEPL-392; AD-623509) CFSTI: HC $1.00/MF $0.50

High electric field strengths were produced in two superconducting rf cavities with electroplated lead surfaces. The cavities operate near 2856 MHz in modes which are useful for particle acceleration. In a cylindrical cavity operating in the TM 010 mode a Q of 2.5×10^8 was obtained at 2° K. At a power input into the cavity of 2.5 watts a maximum electric field strength on the axis of about 100,000 volts/cm was produced. Also tested was a resonant section of disk-loaded accelerator structure three periods in length operating in the $2\pi/3$ mode. In this cavity a maximum electric field of 150,000 V/cm was obtained. In both cavities the electric field strength appeared to be limited by electron loading due to field emission. Radiation, which at times exceeded 100 mR/hr, was measured in the vicinity of the cavities. The radiation provides indirect evidence of strong accelerating fields. Author (TAB)

N66-14486# Bureau of Mines, College Park, Md.
MEASUREMENT OF LATERAL PRESSURE GENERATED FROM CYLINDRICAL EXPLOSIVE CHARGES
Lippe D. Sadwin and Norman M. Junk 1965 12 p refs
(BM-RI-6701)

This report describes a high-speed streak camera technique for measuring the lateral shock pressure generated by a cylindrical explosive charge detonated from one end. Experimental

data show that the magnitude of the lateral pressure is approximately 50 percent that of the pressure generated from the terminal end of the charge for three explosives studied. Author

N66-14488# Instituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
THE SEMINAR AT THE PHYSICS LABORATORY DURING THE PERIOD JANUARY–APRIL 1965 [IL SEMINARIO DEI LABORATORI DI FISICA NEL QUADRIMESTRE GENNAIO–APRILE 1965]
M. Di Girolamo et al 20 May 1965 57 p In ITALIAN; ENGLISH summary
(ISS-65/18) CFSTI: HC $3.00/MF $0.50

A synopsis is presented for lectures delivered at the Physics Laboratory at the Instituto Superiore di Sanita in Rome. Papers deal with biophysics, nuclear physics, quantum mechanics, and related subjects. Among the lecture titles are (1) *Symmetry Group Containing Unitary Spin and Poincaré Group*, (2) *Electron Beams, Acoustic Waves, and Spin Waves for Long-Time Microwave Signal Delay*, (3) *Proton Binding Energies*, (4) *Perturbation Theory and Infinite Renormalization Constants*, (5) *Some Data on Ribosomes and Informosomes*, and (6) *Particles with Zero Spin*. Other lectures consider mutations and recombinations, plasma collisions, charge density and fluctuation in electromagnetic radiation. Transl. by M.W.R.

N66-14502# California Univ., Berkeley.
ON THE LYAPOUNOV CENTER THEOREM
Al Kelley, Jr. 7 Oct. 1965 10 p refs
(Contract Nonr-22288)
(AD-623021) CFSTI: HC $1.00/MF $0.50

Lyapounov proved there exists a 1-parameter family y periodic orbits for certain analytic Hamiltonian systems. The question of the differentiability of the resulting manifold of periodic selections was not considered. C. L. Siegel proved the analyticity of the resulting manifold. The results given in the present work settle the problem of existence and smoothness of the manifold for non-analytic systems. Author (TAB)

N66-14545# IIT Research Inst., Chicago, Ill.
CONTINUOUS FACSIMILE SCANNER EMPLOYING FIBER OPTICS Quarterly Report No. 3, 1 Jan.–31 Mar. 1965
Donald A. Pontarelli 20 Oct. 1965 16 p
(Contract DA-28-043-AMC-00164(E))
(IITRI-A-6093-9; AD-623204) CFSTI: HC $1.00/MF $0.50

The major area of effort this quarter concerned the preparation of the design plan which was submitted at the end of February. Research effort in electronics has been concentrated on the motor drive electronics, signal processing, and consideration of photodetectors. Mechanical engineering has continued the design and fabrication of the copy transport drive which is essential to the further study of the fiber optic scanning system and the optical performance of single layers of fiber. In the latter area, intensive study of the causes of photometric defects in copy exposed through a fiber sheet has indicated the necessity of extensive and detailed study of all aspects of fiber drawing and fiber sheet fabrication. Author (TAB)

N66-14549# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
POLARIZATION OF INFRARED RADIATION BY BREWSTER ANGLE REFLECTION FROM A GERMANIUM SURFACE
George E. Schropp (M.S. Thesis) Aug. 1965 85 p refs
(GE/EE/65-23; AD-623141) CFSTI: HC $3.00/MF $0.75

A study was made of the polarization of the reflected component of infrared energy that is incident at the Brewster angle upon the plane surface of a germanium sample. The principal surfaces of the germanium sample are optically flat and are parallel to within 5 seconds of arc. A polariscope, designed to fit the Perkin-Elmer Model 13 Infrared Spectrophotometer, is fabricated with provision for the independent adjustment of the angle of incidence of both the polarizer and the analyzer along with the independent freedom of rotation of the analyzer to permit crossing the two stages. The calculated Fresnel curves are verified with experimental data for 2.1 microns, and the polarization versus wavelength is measured and found to be constant for 3.4, 5.0, and 8.3 microns. Author (TAB)

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N66-14568# Honeywell, Hopkins, Minn. Research Center.
THE FIBER STRENGTHENED ELASTIC STRING: FIRST ORDER THEORY
H. Cohen Sep. 1965 27 p refs
(Contract Nonr-4076(00))
(TR-31; AD-622688) CFSTI: HC $2.00/MF $0.50

The theory of a one-dimensional directed elastic continuum is developed on the basis of a principle of virtual work. The strain energy function is restricted to lead to a theory of limited director interaction. A simplified form of the constitutive relations are used to illustrate the possibility of achieving a permanent deformation. Author (TAB)

N66-14582*# United Aircraft Corp., East Hartford, Conn. Research Labs.
THEORETICAL INVESTIGATION OF THE LOWEST FIVE IONIZATION POTENTIALS OF URANIUM
Hugh A. Williamson, H. Harvey Michels, and S. B. Schneiderman Sep. 1965 67 p refs
(Contract NASw-847)
(NASA-CR-69002; D-910099-2) CFSTI: HC $3.00/MF $0.75 CSCL 18J

Ionization potentials were calculated for uranium and its first four positive ions using approximate quantum mechanical methods. A range of values was obtained for each ionization potential, with the individual values depending upon the approximations entering into the calculations. The final suggested values are: U(I) - 6.11 e.v.; U(II) - 17.5 e.v.; U(III) - 37.5 e.v.; U(IV) - 61 e.v.; U(V) - 118 e.v. Ionization potentials for U(I) through U(III), differing only slightly from these final suggested values, were employed in an evaluation of the following properties of equilibrium mixtures of hydrogen and uranium: species concentration, coefficients of viscosity and diffusion, and effective Schmidt number. The calculations were performed at pressures of 100, 500, and 1000 atm., temperatures of 20000 K, 60000 K, and 100000 K, and fuel partial pressure fractions of 0.09, 0.1, 0.233, 0.367, 0.5, 0.633, 0.767, and 0.9. The results of these calculations indicate that the uranium ions of lower valency play an important role in the determination of the properties of the mixture up to temperatures higher than had been indicated in preceding studies, thereby raising significantly both the mixture viscosity and effective hydrogen–uranium binary diffusivity at temperatures below about 60000 K. Since the changes in these two quantities are in the same direction, however, changes in the effective Schmidt number are small. Author

N66-14621# Michigan State Univ., East Lansing. Ultrasonics Lab.
IMAGE FORMATION IN OPTICAL SYSTEMS THAT UTILIZE AMPLITUDE AND PHASE MASKS IN THE FOURIER IMAGE PLANE

John F. Kelsey Aug. 1965 53 p refs
(Contract Nonr-2787(01))
(TR-13; AD-470297)

The Foucault knife edge test, the schlieren system, the phase contrast method, and the concepts of spatial filtering and theta modulation are all characterized by the same mathematical expressions. These concepts are all treated here as a group and are termed Fourier Mask Optics where the word mask includes phase masks as well as the usual sense, i.e., amplitude masks. A general mathematical procedure is derived from basic principles and the manner in which the aforementioned concepts fit into this mathematical framwork is shown by way of a simple example of each case. Several illustrations of interesting subjects are also shown, with emphasis on the schlieren system and the special case of isochromates.

Author (TAB)

N66-14628*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
CHARACTERISTICS OF LIQUID–SOLID MIXTURES OF HYDROGEN AT THE TRIPLE POINT Summary Report, 1 Mar. 1964–30 Jun. 1965
D. B. Mann, P. R. Ludtke, C. F. Sindt, D. B. Chelton, D. E. Daney et al 1 Oct. 1965 170 p refs
(NASA Order CC-14032)
(NASA-CR-69092; NBS-8881) CFSTI: HC $5.00/MF $1.00 CSCL 20M

Properties and characteristics of liquid–solid mixtures of hydrogen, including production methods, solid particle sizes, particle size distribution, aging effects, and terminal velocities of the solid particles in triple point liquid have been studied. Preliminary studies and dewar pressurization techniques for liquid–solid mixtures are discussed. Consideration has also been given to possible methods of obtaining homogeneous or colloidal mixtures. The equipment developed and the results described are part of an effort to determine techniques and parameters pertinent to the study of production, storage, and pipe line transport of this upgraded fuel.

Author

N66-14683# National Aeronautical Lab., Bangalore (India).
ACOUSTIC OSCILLATIONS IN NON-ADIABATIC FLOW SYSTEMS
S. N. B. Murthy Jun. 1965 95 p refs
(TN-PR-1-65) CFSTI: HC $3.00/MF $0.75

An acoustic-type disturbance which is expected to retain its character throughout the period of interaction with a chemically-active flow system, such as a liquid propellant rocket engine, is investigated. In order to study the large scale pressure oscillations which occur in the combustion or thrust chamber, consideration is given to (1) propagation characteristics of a simple acoustic signal in a chemically active medium, (2) conditions which sustain and amplify such a disturbance, and (3) conditions which will sustain and amplify a postulated standing wave in the system. A study of the amplification of a pressure oscillation shows that the rate of energy release determines whether the disturbance is to amplify or decay. Principal parameters in the formation of a standing wave are the time and space rates of energy release, width and location of energy release zone, and conditions in the regions bounding the nonadiabatic region. In these studies all time delays associated with relaxation processes are omitted.

M.W.R.

N66-14715# Wisconsin Univ., Madison. Mathematics Research Center.
OBSERVABLES AND DERIVABLES. PART II: UNIQUENESS AND EXISTENCE PROPERTIES
Stanley P. Gudder Jul. 1965 23 p refs
(Contract DA-11-022-ORD-2059)
(MRC-577; AD-623743) CFSTI: HC $1.00/MF $0.50

Certain uniqueness and existence properties of bounded observables are discussed. The uniqueness problem considers the question: If two bounded observables have the same expectations in every state, are the observables equal? We say that an observable Z is the sum of two bounded observables X and Y if the expectation of Z is the sum of the expectations of X and Y for every state. The existence problem poses the question: Does the sum of two bounded observables exist? Only partial answers to these questions have been found. It is shown that the uniqueness property holds for simultaneous observables and certain classes of non-simultaneous or complementary observables. The existence property holds for simultaneous observables and a counter example is given which shows that this property does not hold in general. Logics in which the uniqueness and existence properties hold are considered.

Author (TAB)

N66-14732# Wisconsin Univ., Madison. Mathematics Research Center.
OBSERVABLES AND DERIVABLES. PART III: SEMI-GROUPS
Stanley P. Gudder Jul. 1965 14 p refs
(Contract DA-11-022-ORD-2059)
(MRC-573; AD-623741) CFSTI: HC $1.00/MF $0.50

The temporal development or dynamics of a quantum mechanical system is usually described in terms of a semi-group of unitary operators. In any more general axiomatic formulation of quantum mechanics a similar assumption would likely be made. The energy observable is defined as the infinitesimal generator of this semi-group. Also, the momentum observables are defined as the infinitesimal generators of semi-groups corresponding to rigid motions in configuration space. Basic results are derived concerning semi-groups of bounded simultaneous derivables.

TAB

N66-14780*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE EFFECT OF TRANSDUCER IMPEDANCE ON DYNAMIC MEASUREMENTS
I. P. Vatz (Brown Eng. Co.) 7 May 1965 38 p refs
(NASA-TM-X-53254) CFSTI: HC $2.00/MF $0.50 CSCL 14B

There are inherent limitations in the use of vibration measurement transducers because of the effective mechanical impedance added to the mechanical system by the transducers themselves. A method of calculating the error thus imposed is presented. Equations are derived that give the useable frequency band based on a given allowable maximum error for accelerometers and impedance heads.

Author

N66-14859# Little (Arthur D.) Inc., Cambridge, Mass.
HIGH INTENSITY NANOSECOND DISCHARGES IN THE STUDY OF ELECTRO-OPTICAL AND CHEMICAL PROCESSES Final Report, 26 Aug. 1963–26 Aug. 1965
Alfred Büchler and Emma Duchane [1965] 18 p refs *Its* Rept.-65842
(Contract AF 19(628)-3822)
(AFCRL-65-729; AD-624112) CFSTI: HC $1.00/MF $0.50

The principal purpose of the work was to investigate the feasibility of using high intensity, ultra short time (nanosecond) discharges to study very fast electro-optical and chemical processes. A survey of the state of the art of flash photolysis showed that the availability of nanosecond spectroscopic light sources

would provide a significant extension of the range of electro-optical and chemical processes presently accessible to study by flash photolytic techniques. The problem of adapting the Fischer nanosecond spark source for this purpose was therefore studied, and a series of experiments were undertaken to demonstrate the feasibility of using it as a spectroscopic source in flash photolysis. These experiments showed that in fact the Fischer source could be successfully adapted for these purposes. Author (TAB)

N66-14867# Utah State Univ., Logan. Electro-Dynamics Labs.
NONLINEAR PHASE CORRECTION OF INTERFEROGRAMS OBTAINED IN FOURIER SPECTROSCOPY Scientific Report No. 2
Michael L. Forman, W. H. Steele, and George A. Vanasse 1 Jul. 1965 100 p refs
(Contract AF 19(628)-251)
(AFCRL-65-518; AD-624086) CFSTI: HC $3.00/MF $0.75

A review of the theory and techniques of Fourier spectroscopy is given, and the present state-of-the-art of reducing data obtained by this means is discussed. Certain inherent problems are present in today's methods of reducing the data obtained by Fourier spectroscopy techniques, the so-called interferogram. They are: (1) In the case of a symmetric interferogram where digital recording is used, the point corresponding to zero path difference may not be recorded. A simple cosine transform of this data leads to incorrect results. (2) In the case of improper compensation of an interferometer, asymmetric interferograms result. The method of reducing these is to pick an approximate center, take a sine and cosine transform about it, and compute the spectrum as the square root of the sum of the squares of the sine and cosine transform respectively. There are two disadvantages to this type of reduction, namely that one requires twice as many points to obtain the same resolution as in the symmetric case, and that the process is nonlinear with respect to signal-to-noise ratio in the spectrum. A method is proposed which eliminates the above problems, and yields spectral values that are accurate to within one to three percent. It is based on the fact that there is a fixed function of the interferometer, the so-called phase error, and by making suitable use of it, one can obtain a secondary interferogram from the original interferogram which is symmetric about an effective zero path difference. Hence only a cosinunclassified is required. Author (TAB)

N66-14871# Royal Aircraft Establishment, Farnborough (England).
OBSERVATIONS ON THE STABILITY OF ACTIVE LINEAR SYSTEMS [REMARQUES SUR LA STABILITE DES SYSTEMES LINEAIRES ACTIFS]
Robert Mazet Aug. 1965 19 p Transl. into ENGLISH from French Presented at the Intern. Union for Theoret. and Appl. Mech., Symp. on Vibrations, Paris, 13–15 Apr. 1965
(RAE-LIB-TRANS-1123) CFSTI: HC $1.00/MF $0.50

The dynamic stability of active linear systems is discussed. A binary system is examined and, by neglecting the cross-inertia and cross-damping terms, the effects of stiffness coupling determined. The three classes of procedure used to investigate the dynamic stability of a multi-degree-of-freedom linear system are reviewed. These are through the characteristic equation; through the transfer function, and through the roots via the coefficients of the equation. Author

N66-14903*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BEHAVIOR OF A SINGLE-TURN MAGNETIC COIL UNDER DYNAMIC LOAD CONDITIONS
M. D. Williams and G. K. Oertel Washington, NASA, Jan. 1966 14 p refs
(NASA-TN-D-3199) CFSTI: HC $1.00/MF $0.50 CSCL 20C

Dynamic stress calculations were carried out for a thin single-turn coil which is much longer than its radius. It was assumed that the mechanical oscillation amplitude is always much smaller than the radius, and that the pressure amplitude is not affected by the mechanical oscillations. The equation of motion was derived from a Lagrangian, and the explicit solution for single-turn coils was solved by the Laplace transform method. The predictions based upon these calculations were used in an experiment under conditions similar to those planned for a 1-megajoule magnetic compression experiment. A short coil was tested with a small capacitor bank connected to the coil by high inductance busses which can be switched with a single triggered air gap. The experimental setup is depicted, and the discharge circuit and coil parameters are tabulated. Graphs show the displacement of the coil oscillations for values of the natural angular frequency of the coil, and the angular frequency of electrical discharge as a function of time; and the static stress–strain characteristic of the coil material is plotted. Good agreement between experimental and theoretical results was found for this experimental arrangement. M.G.J.

N66-14954*# Northwestern Univ., Evanston, Ill. Structural Mechanics Lab.
SOME GENERAL CONSIDERATIONS CONCERNING THE DESTABILIZING EFFECT IN NONCONSERVATIVE SYSTEMS Technical Report No. 65-2
S. Nemat-Nasser and G. Herrmann Jun. 1965 26 p refs
(Grant NsG-605)
(NASA-CR-69209) CFSTI: HC $2.00/MF $0.50 CSCL 20K

A linear system with N degrees of freedom subjected to a set of nonconservative forces which depend linearly on generalized coordinates is considered. Several theorems concerning the destabilizing effect induced by the presence of small forces which depend on generalized velocities are established. These forces may be due to viscous damping and gyroscopic effects. Author

N66-14991 Joint Publications Research Service, Washington, D. C.
ON OPTIMIZATION OF A CONTINUOUS PRODUCTION PROCESS DESCRIBED BY SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS
Yu. M. Volin and G. M. Ostrovskiy *In its* News of the Acad. of Sci. USSR, Dept. of Tech. Sci., Tech. Cybernetics 27 Dec. 1965 p 197–204 refs (See N66-14976 05-10) CFSTI: $6.00

The procedures for solution of optimal problems which arise during optimization of some typical chemical-technical systems are investigated. Author

N66-15010# Adelaide Univ. (Australia). Dept. of Physics.
PARTIAL PHOTOIONIZATION CROSS SECTIONS FOR MOLECULAR OXYGEN
A. J. Blake and J. H. Carver Oct. 1965 11 p refs Sponsored by Australian Dept. of Supply CFSTI: HC $1.00/MF $0.50

The energy distributions of photoelectrons from molecular oxygen have been measured by a retarding potential method and partial photoionization cross sections corresponding to individual transitions have been determined for photons in the range 584 to 710Å. Author

N66-15026# Syracuse Univ. Research Inst., N. Y. Dept. of Electrical Engineering.

A PROPOSED MEASURE FOR THE INFORMATION CONTENT IN QUANTUM FIELDS Technical Report No. 8

Daniel Schutzer 17 Aug. 1965 109 p refs

(Contract Nonr-669(10))

(EE494-658T-8; AD-622517) CFSTI: HC $4.00/MF $0.75

Under the present formulation of Quantum Mechanics, there exists a vacuum energy. The function describing an elementary particle, the field function, has random fluctuations superimposed upon it. An existence information measure is proposed to describe the information contained in a particle field. Existence information is the uncertainty in making the decision that a particle field exists, in light of the vacuum fluctuation effect. Relationships between the existence information and basic intuitive ideas of information theory are brought out. Connections are shown between Shannon's formulation of information theory, Wigner's skew information measure, and the proposed, existence information. Plausibility arguments for the appropriateness of existence information as the representation of field information are presented. Interactions between particles, and the self-interference of a particle is discussed and related to distinguishability, choice, correlation and existence information. Electromagnetic scattering is discussed and is associated with the coherence between the two particles vacuum fluctuations. Existence information is calculated and studied as a function of measurements and interactions. The total existence information content of an isolated system, (possibly interacting internally) is found to be independent of time. Author (TAB)

N66-15046 Joint Publications Research Service, Washington, D.C.

COUPLING WAVE THEORY OF GUIDE WAVE PROPAGATION IN FERRITE CYLINDER WITH VARYING CROSS SECTION

Hung-Chia Huang and Tian-Yuan Fan *In its* Transl. on Communist China's Sci. and Technol. 6 Dec. 1965 4 p Transl. into ENGLISH from K'o-Hsueh T'ung- Pao (Peking), no. 9, 20 Sep. 1965 p 830–831 (See N66-15042 05-34) CFSTI: $3.00

The coupling wave theory was used to analyze the guide wave propagation in ferrite cylinders of varying cross sections. Ordinary coupling wave equations were obtained through the orthogonal function expansion method and applied to the Faraday rotation of the guide wave in a longitudinally magnetized ferrite cylinder with transition sections. Any form of geometric deformation can be reflected in the coupling coefficient. G.G.

N66-15069*# United Aircraft Corp., East Hartford, Conn. Research Labs.

INVESTIGATION OF THE KINETICS OF CRYSTALLIZATION OF MOLTEN BINARY AND TERNARY OXIDE SYSTEMS Quarterly Status Report No. 1, 1 Sep.–30 Nov. 1965

J. F. Bacon 30 Dec. 1965 17 p refs

(Contract NASw-1301)

(NASA-CR-69145; D910373-1) CFSTI: HC $1.00/MF $0.50 CSCL 20B

Progress is summarized in an experimental research investigation of the kinetics of crystallization of molten binary and ternary oxide systems. It is reported that the first oxide system selected for investigation ($Mg_2Al_4Si_5O_{18}$) was successfully melted and electrical conductivity measurements were obtained from 860° C to 1560° C. It is also reported that Young's modulus was measured for the bulk glass and found to be 15×10^6 lbs/in^2. A table is included of the dynamic modulus for cordierite based glasses. C.T.C.

N66-15113 Catholic Univ. of America, Washington, D. C. Dept. of Electrical Engineering.

THE COVARIANCE OF THE TEMPERATURE MICROSTRUCTURE IN TIME AND SPACE

Dominick Edward Santarpia *In its* Elec. Eng. Res. Rev., No. 4, Jun. 1965 p 1–14 refs (See N66-15112 05-34)

Random variations in amplitude are observed when uniform sound pulses are transmitted in water in which there are random variations in space and in time of the refraction index. Refractive index variations are produced by temperature fluctuations in the medium. Temperature variations cause a corresponding change in sound velocity, resulting in acoustic signal scattering. These acoustic fluctuations are related to statistical parameters which describe the temperature microstructure. Previous studies have demonstrated that acoustic amplitude variations are dependent on parameters of the scattering medium, as well as the acoustic frequency and range from acoustic source to receiver. The parameters of the medium contributing to the scattering of acoustic signals are the rms refractive index deviation from unity and the normalized spatial covariance of the temperature microstructure. In conjunction with the study of the normalized spatial covariance, research was conducted to study the normalized time covariants of the temperature microstructure. The normalized time covariance is directly related to the correlation of scattering of successive acoustic pulses. R.N.A.

N66-15123# Library of Congress, Washington, D. C. Aerospace Technology Div.

RESEARCH ON F-VALUES Surveys of Soviet Scientific and Technical Literature

Edward Gelins 7 Dec. 1965 50 p refs Comprehensive Rept. (ATD-65-86)

Research on oscillator strengths of electron transitions from one energy level to another as shown in the spectral lines of chemical elements published in Soviet literature is abstracted and evaluated. No special annotation is given in this bibliography which is a continuation of a previous work entitled "Research on f-Values". Articles dealing with both theoretical and experimental investigations are included. The author's conclusion contains an evaluation of the general approach to the problem of oscillator strengths of spectral lines and new methods introduced in investigations, and comments on individual works. R.N.A.

N66-15178# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

STUDIES OF ICE I: APPLICATION OF THERMAL ETCHING TO THE STUDY OF SURFACE ABRASION IN ICE CRYSTALS

Daisuke Kuroiwa May 1965 33 p refs Work done in part at Hokkaido Univ.

(CRREL-RR-142; AD-624199) CFSTI: HC $2.00/MF $0.50

Thermal etching of ice and its application to the investigation of surface abrasion in ice crystals is explained. Investigations of surface abrasion in ice crystals provide fundamental information in the study of snow and ice friction. The technique of producing evaporation etch pits by the application of Formvar film to the ice crystal surface is described, and the development of microcrystals by recrystallization is compared with the surrounding mother crystals. Experimental data are presented and discussed with emphasis on the development of thermal etch pits, scratches on different crystal faces, damage to the prismatic face, thermal etch channels on the basal plane, predominant orientation of etch channels on the basal plane, and etch-pit-free zones and stress concentrations around solid inclusions. Author (TAB)

N66-15190# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
A LOW ENERGY NITROGEN ION BEAM
R. H. Prince May 1965 70 p refs
(Contract Nonr-4073(00))
(UTIAS-TN-80; AD-623776) CFSTI: HC $3.00/MF $0.75

Apparatus has been constructed for the production of a nitrogen ion beam (N_2^+) within the energy ranges 5 to 30eV. Retarding field analysis of the ion energy distribution of a typical 8eV (nominal) beam reveals a width at half maximum of 0.25eV, 50 percent within a 1.25eV energy range. Present intensities are of the order 10^9 ions/sq cm-sec. Estimates of the ion reflection coefficient and secondary electron emission coefficient have been obtained during calibration, at energies sparsely reported in the literature, and are in general agreement with existing data, where available. Author (TAB)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N66-14351# Atomic Weapons Research Establishment, Aldermaston (England).
NEUTRON CROSS SECTIONS OF THE PROTON IN THE ENERGY RANGE 0.0001 eV–20 MeV
A. Horsley London, HMSO, 1965 29 p refs
(AWRE-O-23/65) BIS: $0.80; HMSO: 4s

Recommended values are given for neutron total and partial cross sections of H-1 in the energy range 0.0001 eV to 20 MeV. The available experimental data are supplemented where necessary by estimates based on nuclear theory. Details of energy and angular distributions are given so that the data are complete for the purposes of neutronics calculations. The recommended data were written on punched cards (3A/H data, data file number DFN = 211, for the cross sections of free hydrogen atoms, and 3B/H data, data file number DFN = 212, for the cross sections per hydrogen atom of a water molecule) as part of the UKAEA Nuclear Data Library. Author (NSA)

N66-14472# Stanford Univ., Calif.
A 200 MeV SUPERCONDUCTING RACETRACK MICROTRON
B. H. Wiik, H. A. Schwettman, and P. B. Wilson Sep. 1965 14 p refs Presented at the Vth Intern. Conf. on High Energy Accelerators, Frascati, Italy, 9–16 Sep. 1965
(Contract Nonr-225(67))
(HEPL-396; AD-623659) CFSTI: HC $1.00/MF $0.50

A race-track microtron is proposed consisting of two 180 degree magnets spaced 2.5 meters apart with a superconducting linac section between. The magnets are two meters in diameter with a homogeneous field of 8 kilogauss. The linac section will operate at 1.2 kmc and provide an energy gain of 10 MeV per turn. The electrons are injected into the microtron at about 12 MeV from a second superconducting accelerator section. The spacing between orbits is 8 cm. Thus vertical and radial focusing can be provided on any orbit by quadrupoles placed in the field-free region between the magnets. The phase error due to the fringing fields of the magnets has been calculated and can be compensated. An energy resolution of 0.001 is expected. Using superconducting linac sections, a beam current of 100 microamps at unity duty cycle is feasible. It is also possible to build the microtron using conventional linac sections. For such a machine a duty cycle greater than one percent is reasonable. Author (TAB)

N66-14493# Naval Civil Engineering Lab., Port Hueneme, Calif.
COMPARISON OF EXPERIMENTAL AND THEORETICAL GAMMA RAY ALBEDO Interim Report
C. M. Huddleston 10 Jan. 1964 9 p refs
(Contract DASA-WEB-11.026)
(TN-567; AD-431671) CFSTI: $1.10

An intercomparison is made between the results of Monte Carlo calculations and two independent experimental determinations of values for the differential dose albedo of gamma rays on concrete. The validity of a semiempirical formula for gamma-ray albedo is examined. Information is presented on the current status of our knowledge of gamma-ray albedo, and the direction of future work is indicated. Author (TAB)

N66-14495# Instituto Technologico y de Estudios Superiores de Monterrey (Mexico).
CHANGE OF THE MOMENTUM AND ENERGY OF ELECTRONS FROM SYSTEMS WITH VARIABLE PHYSICAL STATES
Felix Castillo Jimenez [1964] 6 p refs
(Grant DA-ARO-49-092-64-G43)
(AD-621558) CFSTI: HC $1.00/MF $0.50

The difference between the momentum distributions of electrons in the liquid and solid states has been investigated. The technique used is to measure the angular correlation of the gamma rays which are emitted when positrons are annihilated by the electrons of the substance under study. A significant difference in the momentum distribution of electrons in the two phases has been observed. The substances used in the investigation were paraffin, candelilla wax, campeche wax and synthetic wax. Author (TAB)

N66-14522# Stanford Univ., Calif.
WIDE ANGLE ELECTRON-ELECTRON SCATTERING ON THE PRINCETON-STANFORD STORAGE RINGS
W. C. Barber, B. Richter, G. K. O'Neill, and B. Gittelman (Princeton Univ.) Sep. 1965 19 p refs Presented at 5th Intern. Conf. on High Energy Accelerators, Frascati, Italy, 9–16 Sep. 1965
(Contract Nonr-225(67); Nonr-1858(39); AT(04-3)-515)
(HEPL-405; AD-623658) CFSTI: HC $1.00/MF $0.50

The angular distribution of 416 electron-electron scattering events occurring when beams of 300 MeV electrons collide has been measured. The experimental angular distribution was compared with that predicted by the Moller formula with a cut-off on the photon propagator. The best fit occurs for 1/K = about 0.18 Fermi. The value 1/K = 0 (no breakdown of quantum electrodynamics) is only one standard deviation from the best fit. TAB

N66-14599# Library of Congress, Washington, D. C. Aerospace Information Div.
RESEARCH ON f-VALUES Review of Soviet Literature
29 Apr. 1964 78 p refs
(AID-O-64-31; AD-622239) CFSTI: HC $3.00/MF $0.75

Soviet literature on f-values of electron transitions which characterize the oscillator strength of atomic spectral lines published since 1958 is reviewed. TAB

N66-14612# Dublin Inst. for Advanced Studies (Ireland).
INTRODUCTION TO THE GROUP THEORY OF ELEMENTARY PARTICLES
James Mc Connell 1965 124 p refs *Its* Commun. of the Dublin Inst. for Advanced Studies, Ser. A, No. 18 CFSTI: HC $4.00/MF $1.00

The elementary particles of nuclear physics are described and the application of quantum mechanics to the understanding of nuclear reactions is discussed in terms of Lie algebras with special reference to SU(2) and SU(3) symmetry groups. The text is divided into the following chapters: *The Elementary Particles; The SU(2) Group; Lie Algebras; Root Diagrams; Weights; Weight Diagrams; Product Representation; Explicit Representation of the SU(3) Group; The B(2) Group;* and *Experimental Consequences of the SU(3) Theory.* E.E.B.

N66-14740# United Kingdom Atomic Energy Authority, Wantage (England).
THE FORMATION OF Y^{89m} BY 14 MeV NEUTRON IRRADIATION OF ZIRCONIUM
C. Fern, D. Gibbons, and G. Olive London, HMSO, Jul. 1965 11 p refs Presented at the Advanced Seminar on Activation Analysis, San Deigo, Calif., Apr. 1965
(AERE-R-5009) HMSO: 2s 6d

A gamma ray of 0.92 Mev energy and 16 sec half-life was observed in the spectrum of zirconium irradiated with 14 Mev neutrons. This was attributed to yttrium-89m produced by the $^{90}Zr(n,pn)^{89m}Y$ reaction. The cross section for this reaction was measured relative to the $^{90}Zr(n,2n)^{89m}Zr$ and $^{90}Zr(n,2n)^{89}Zr$ reactions and an average value of 27.5 ±0.8 mb obtained. This value may, however, include a contribution from the $^{91}Zr(n,t)^{88m}Y$ reaction. Author (NSA)

N66-14799# Naval Radiological Defense Lab., San Francisco, Calif.
NUCLEAR TRACK REGISTRATION IN DOSIMETER GLASSES FOR NEUTRON DOSIMETRY IN MIXED RADIATION FIELDS
Klaus H. Becker 5 Aug. 1965 40 p refs
(USNRDL-TR-904; AD-623384) CFSTI: HC $2.00/MF $0.50

The fission track detection in fission foil/glass combinations avoids most of the disadvantages of the conventional methods (nuclear track evaluations and activation foils) for integrating neutron measurements. These systems are insensitive to gamma radiation, temperature, climatic and chemical disturbances, easy to evaluate, have no directional dependence, an extended dose and energy range, superior accuracy, etc. The method has been investigated, using different dosimeter glasses, etching conditions, fissionable materials and neutron energies between thermal and 14 MeV. The fission track detection efficiency is 100%, the sensitivity for fissionable metals thicker than ca. 5 microns is 0.000013 tracks/neutron/barn. Simple evaluation techniques and practical applications, mainly for fast neutron personnel dosimetry, are described. Author (TAB)

N66-14916*# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
THE ENERGY DEPENDENCE OF THE NEUTRON CAPTURE CROSS SECTION OF THE TUNGSTEN ISOTOPES FROM .01 TO 10 EV
S. J. Friesenhahn, E. Haddad, F. H. Frohner, and W. M. Lopez [1965] 52 p refs
(Contract SNPC-27)
(NASA-CR-54860; GA-6832) CFSTI: HC $3.00/MF $0.50 CSCL 20H

Capture cross section measurements from 0.01 to 10 eV on W^{182}, W^{183}, W^{184}, and W^{186} employing a totally absorbing gamma ray detector are described. The 2200 m/sec value of the capture cross section is compared with previously reported measurements, and the shape and magnitude of the cross section curve is compared to calculations using reported resonance parameters. Parameters of negative energy levels required to account for the discrepancy between measured and calculated cross sections for W^{182} and W^{184} are given. A measurement of the gold capture cross section is used as a check on the techniques employed. Author

N66-14953*# Oak Ridge National Lab., Tenn.
A GENERAL CATEGORY OF SOLUBLE NUCLEON-MESON CASCADE EQUATIONS
F. S. Alsmiller Dec. 1965 39 p refs
(NASA Order R-104; Contract W-7405-ENG-26)
(NASA-CR-69210; ORNL-3746) CFSTI: HC $2.00/MF $0.50 CSCL 20H

The set of coupled equations describing a one-dimensional nucleon–meson cascade fed by arbitrary space and energy-dependent sources is reduced to quadrature under the following assumptions: (1) charged-particle stopping, meson decay, and deviation of the nonelastic collision cross sections from a single constant value are neglected for the secondary particles produced in the cascade; (2) the secondary particle differential production spectra, $F_{jk}(E,E')$, which give the number per unit energy, E, of j-type particles produced in a nonelastic collision of a k-type particle of energy E' with a target nucleus are taken to be of a general form. Author

N66-15072*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
THE SUDDEN APPROXIMATION APPLIED TO MOLECULAR PROBLEMS. I: NON-REACTIVE COLLISIONS
J. L. J. Rosenfeld 27 Sep. 1965 31 p refs Sponsored in part by ARPA Prepared in cooperation with Brown Univ.
(Grant NsG-275-62)
(NASA-CR-69142; WIS-TCI-128) CFSTI: HC $2.00/MF $0.50 CSCL 20H

The sudden approximation for transition probabilities is derived using an evolution operator formalism. The assumptions required are explicitly stated and their validity and applicability are discussed in relation to energy transfer during collisions between molecules and atoms. It is shown that sufficient conditions ensuring the validity of the sudden approximation are (1) that a classical description be adequate to describe the relative motion of the molecules or atoms, and (2) that the energy levels of the states mainly involved in the process be such that the product of their energy difference and the collision time be small compared to h. Author

N66-15074# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.
A POSSIBLE EXPERIMENT WITH A PROTON POLARIZED TARGET
P. Bounin 19 Jul. 1965 28 p refs *Its* Nota Interna 283
(LNF-65/22) CFSTI: HC $2.00/MF $0.50

A brief description is given of the construction principles of a polarized proton target, and an electron scattering experiment utilizing this target. Discussions are included of technical considerations related to the target, and a possible experiment to check the validity of the Born approximation. Other possible experiments discussed include electron scattering on a polarized deutron target and photoproduction of pi mesons on a polarized proton target. C.T.C.

N66-15075# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
OPTIK 2: A PROGRAM FOR MAGNETIC CHANNEL DESIGN [OPTIK 2: UN PROGRAMMA DI CALCOLO DELL' OTTICA DEI CANALI MAGNETICI]
G. Carloni and G. Fronterotta 1 Feb. 1965 84 p refs In ITALIAN; ENGLISH summary
(ISS-65/4) CFSTI: HC $3.00/MF $0.75

A program to aid the design of magnetic channels for high energy particles was developed. The computation is done introducing the usual six component vector to represent position, direction, momentum spread, and mass of the beam particles. Problems of focussing of the beam may be solved imposing single or double focussing or parallelism in either plane and finding the corresponding values of quadrupole strength. Slit effects are evaluated through the limitation of the phase space referred to the source. Author

N66-15082# Atomic Energy Commission Research Eetablishment, Riso (Denmark).
ON THE DETERMINATION OF INTERATOMIC POTENTIALS IN METALS BY ELECTRON IRRADIATION EXPERIMENTS
H. H. Anderson and P. Sigmund (Aarhus Univ.) May 1965 24 p refs
(RISO-103) CFSTI: HC $1.00/MF $0.50

The repulsive interaction between two atoms in a crystal is described by a Born-Mayer potential $V(r) = A \exp(-r/a)$. The parameters A and a are determined by an interpretation of measured threshold energies for displacement due to irradiation with electrons. The method is similar to that of Lucasson and makes use of the theory of collision sequences and of computer calculations on slowing-down. Measurements by Sosin and Garr on Cu single crystals suggest that $.18\text{Å} \leq a \leq .23\text{Å}$ for Cu. Several schemes of scaling potential parameters as a function of the atomic number are examined. The best one appears to be $a = \text{const.}, A \propto Z^{3/2}$. The potential parameters finally adopted are $a = .219\text{Å}$, $A = 52\,Z^{3/2}$ ev. The agreement of estimated and experimental E_d values for several FCC and BCC metals is satisfactory. The resulting parameters are compared with Born-Mayer constants determined by other methods, and the origin of some discrepancies is discussed. The present potentials prove to be similar to those of Lucasson, but a final decision on their validity requires some more experimental work on single crystals. Author (NSA)

N66-15086# Pennsylvania Univ., Philadelphia. Dept. of Physics.
FUTURE THEORETICAL AND EXPERIMENTAL RESEARCH ACTIVITIES IN HIGH ENERGY PHYSICS Progress Report, Sep. 1964–Sep. 1965
[1965] 61 p refs
(Contract AT(30-1)-2171)
(TID-22222) CFSTI: HC $3.00/MF $0.50

Details of the progress made during the past year, both experimentally and theoretically, are reported. The area of research is elementary particle physics. Separate abstracts were prepared for the experimental and theoretical research discussed. NSA

N66-15088# Gosudarstvennyi Komitet po Ispolzovaniyo Atomnoi Energii, Moscow (USSR). Institut Atomnoi Energii.
CALCULATING ENERGY LEVELS OF WEAKLY DEFORMED NUCLEI [RASCHET ENERGETICHESKIKH UROVNEI SLABODEFORM-IROVANNYKY YADER]
V. P. Krainov 1965 8 p In RUSSIAN
(IAE-811)

The Schroedinger equation for the single-particle levels of weakly deformed nuclei is used to obtain an expression for the diagonal matrix element of excitation in the first-order perturbation theory in the deformation parameter. A parameter involved in this expression is evaluated for A ~200 and A ~150, using radial wave functions. NSA

N66-15096# California Univ., Los Angeles. Department of Physics.
A GENERAL ORBIT CODE FOR CYCLOTRON ANALYSIS
David I. Hopp May 1965 42 p
(Contract AT(11-1)-34; Nonr-233(44))
(TID-22177) CFSTI: HC $2.00/MF $0.50

A FORTRAN IV computer program for a 32K system is given which will aid in the analysis of the various types of cyclotrons. The main restriction of this version is that there exists a magnetic median plane above and below which field values may be computed by an expansion involving terms linear in displacement. The field is stored in a point-by-point fashion in polar coordinates. A maximum of 6000 points is allowed in this version. NSA

N66-15097# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
THE MULTI-SPHERE TECHNIQUE. I: GENERAL CHARACTERISTICS AND APPLICATIONS [LA TECHNIQUE MULTI-SPHERE. I: CHARACTERISTIQUES GENERALES ET APPLICATIONS]
Henry K. Zaborowski July 1965 57 p refs In FRENCH
(CEA-R 2772)

A study is made of the general characteristics and the applications of the multisphere technique for flux measurements, dosimetry and the spectrometry of neutron sources ranging from thermal up to 7 Mev neutrons. The equations relating to three fluxmeters (proportional long counters) are given for the measurements of the flux. Other equations were derived for multicollision rad and Rem dosimetry and first collision rad dosimetry; and for the spectrometry and dosimetry of neutrons in five energy bands using a method similar to that used by threshold detectors. Author (NSA)

N66-15099# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
SOME ASPECTS OF THE SOLID-LIQUID TRANSITION [QUELQUES ASPECTS DE LA TRANSITION SOLIDE-LIQUIDE]
Pierre Hicter and Yves Malmejac May 1965 86 p refs In FRENCH
(CEA-R-2752)

Current theories of fusion were analyzed and grouped by analogies using a unified symbolism to facilitate comparisons. Theories are presented based on solid state vibrational models, nucleation models, order-disorder models, vacancies, and dislocations. For each model, the hypotheses underlying the theoretical development are defined. Principal results are compared with experimental data. Author (NSA)

N66-15100# Brookhaven National Lab., Upton, N. Y.
THE $Y_1^*(1660)$ PRODUCED IN K^-p INTERACTIONS AT 2.24 BeV/c
G. W. London, R. R. Rau, N. P. Samios, M. Goldberg, M. Primer (Syracuse Univ.) et al [1965] 27 p refs Presented at the Intern. Conf. on Elementary Particles, Oxford
(Contract AT(30-2)-GEN-16)
(BNL-9520; CONF-650945-1) CFSTI: HC $2.00/MF $0.50

The production and decay of the $Y_1^*(1660)^+$ produced in peripheral $K^- + p$ interactions at 2.24 Bev/c is studied. The resonance decays primarily into $Y_0^*(1405) + \pi^+$. A small contribution to the decay through the $\Sigma^+ + \pi^0$ mode is also observed. The Dalitz plot provides no definite information on the spin-parity, but if the K^* exchange model is assumed, the decay angular distributions provide some evidence against $3/2^+$. NSA

N66-15111# Rochester Univ., N. Y. Dept. of Physics and Astronomy.
VECTOR MESON DECAYS AND THE ALGEBRA OF CURRENTS
V. S. Mathur and L. K. Pandit [1965] 12 p refs Sponsored in part by AEC
(UR-875-105)

The Fubini–Furlan method for extracting physical information from the algebra of currents is used to study the renormalization of the strangeness-changing axial vector coupling constant in the decay of vector mesons. R.N.A.

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N66-14420# Polytechnic Inst. of Brooklyn, Farmingdale, N. Y. Microwave Research Inst.
ON THE KINETIC THEORY OF DIFFUSION OF A PLASMA COLUMN ACROSS A MAGNETIC FIELD
Michael J. Haggerty 19 Aug. 1965 38 p refs
(Contract Nonr-839(38); ARPA Order 529)
(PIBMRI-1289-65; AD-471208)

The kinetic theory of Prigogine and Balescu, which was previously developed for a homogeneous plasma in a magnetic field, is now applied to the problem of diffusion of a plasma column across a magnetic field. The problem of deriving a kinetic equation is reduced to that of solving a two dimensional Fredholm-type integral equation with a complicated kernel. No restriction is made concerning the amplitude or length scale of the inhomogeneity across the magnetic field. The results are preliminary in nature, and suggestions are made for further refinements. Some comparisons with previously existing results are given. Author (TAB)

N66-14484# Institut Franco-Allemand de Recherches, St. Louis (France).
MEASURES OF EMISSION BY SHOCK WAVES OF WEAK INTENSITY, PART IIA [LICHTMESSUNGEN AN SCHWACHEN STOSSWELLEN, TEIL IIA]
H. Mach and F. Roessler 4 Jun. 1963 31 p refs In GERMAN
(ISL-3/63) CFSTI: HC $2.00/MF $0.50

The time-velocity relationship of the luminescence that follows a shock wave traveling through a glass tube filled with argon was studied by streak photography. Thermoluminescence was only observed along the tube wall and developed well behind the shock wave front. It was concluded that a change from laminar to turbulent boundary flow with some particle ionization induced the luminescent emission. Transl. by G.G.

N66-14535# Harry Diamond Labs., Washington, D. C.
MERCURY ARC PLASMA TUBE
John A. Rosado 31 Aug. 1965 17 p
(HDL-TM-65-43; AD-623302) CFSTI: HC $1.00/MF $0.50

A general description of a cylindrical, low-pressure mercury arc plasma tube, 51 cm high and 60 cm across, is given. The tube is operated at 15 v dc and may be continuously evacuated by a 6-in mercury diffusion pump. Controlled electron densities of 10^{17} to 10^{19} cu.m. are achieved by adjusting the current from 50 to 2500 amp. The tube was designed for studying interactions between plasma and immersed microwave antenna array systems, and for other studies in which a relatively extensive plasma is desirable. Author (TAB)

N66-14607# Max-Planck-Institut für Physik und Astrophysik, Munich (West Germany).
PRODUCTION AND BEHAVIOUR OF A MAGNETICALLY STABILIZED HIGH-DENSITY HIGH-TEMPERATURE PLASMA
H. Wulff Aug. 1965 17 p refs
(MPI-PAE/PL-12/65) CFSTI: HC $1.00/MF $0.50

In a newly developed linear device a plasma is produced and stabilized magnetically for a length of up to 70 cm and for a total discharge time of 2 msec during which the plasma current and the magnetic field strength are kept constant. Depending on the magnetic field strength, plasma current, contamination of the plasma and other parameters the plasma appears in a steady or an unsteady state. It does not come into contact with the wall in either case. The electron density obtained is about 10^{16} cm^{-3}, the maximum temperature exceeding 200 000° K. Author

N66-14609# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
ANALYSIS OF THE EXPERIMENTAL EFFECTS OBTAINED ON AN ARC BY ARGON [ANALYSE DES RESULTATS EXPERIMENTAUX OBTENUS SUR UN ARC A ARGON]
Jean Fabri 1964 21 p refs In FRENCH Presented at the AGARD Meeting of Specialists on Arc Heaters and Magneto-Hydrodyn. Accelerators for Aerodyn. Usage, Rhode-St-Genese, France, 21–23 Sep. 1964
(TP-134(1964)) CFSTI: HC $1.00/MF $0.50

The comparison of theoretical predictions with experimental results for magnetically stabilized arcs illustrates the overall difficulty of taking into account the properties of real gases. The use of a monatomic gas, argon, which is ideal through a large temperature range, permits a precise confrontation between experimental and theoretical results. In the case of argon, the influence of the principle magnetohydrodynamic parameters—gas pressure and flow, magnetic field and electric current intensity—on the velocity of arc rotation, heat transfer to the walls, and the efficiency of the apparatus is demonstrated. Transl. by D.T.

N66-14648# California Univ., Berkeley. Electronics Research Lab.
SYNCHROTRON RADIATION MEASUREMENTS FROM A PLASMA IN A MAGNETIC MIRROR MACHINE
A. J. Lichtenberg, S. Sesnic, A. W. Trivelpiece, and S. A. Colgate 15 Apr. 1964 14 p refs
(Contract AF 33(615)-1078; Grants AF-AFOSR-139-63; NSF-GP-2239)
(M-62; AD-466895)

It was shown previously that under certain conditions a hot-electron plasma can be confined in a magnetic-mirror configuration for periods of several milliseconds. In a similar experiment, the synchrotron radiation emanating from such a hot-electron plasma was measured to have a peak value greater than 1.0 mW/ster integrated over the 4.0 mm to 0.1 mm wavelength region. The plasma was generated by a deuterium loaded titanium washer stack source which injected plasma into a trapping magnetic mirror field that rises to a maximum mid-plane value of 8.0 kG in 50 sec. A cryogenic InSb far infrared photodetector was connected to the experiment to measure the synchrotron radiation emanating from the hot-electron plasma. The synchrotron radiation and the corresponding single X-ray photon pulses from the end scintillator are shown in relation to the magnetic field whose maximum mid-plane value was 28 kG. The synchrotron radiation signal and corresponding X-ray signal for a magnetic field whose maximum mid-plane value was 60 kG is also shown. E.E.B.

N66-14698# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
SPECIAL EXPERIMENTAL PROBLEMS ON WIND TUNNELS WITH ELECTRIC ARCS [PROBLEMES EXPERIMENTAUX PARTICULIERS AUX SOUFFLERIES A ARC]
Jean-Pierre Chevallier 1965 22 p refs Presented at the Appl. Aerodyn. Colloq., A.F.I.T.A.E., Toulouse, 8–9 Nov. 1965 In FRENCH
(ONERA-TP-290(1965)) CFSTI: HC $1.00/MF $0.50

In wind tunnels with short bursts, called hotshots, the electric arc is used to transport the gas at pressures and temperatures necessary for a discharge at Mach numbers 15 or 20 and at a broad range of Reynolds numbers. The addition of an intermediate volume between the arc chamber and blast pipe gives homogeneous thermal qualities and permanence to the discharge which were lacking up to now; and permits the utilization of bursts of approximately 50 ms in order to make variations in the incidence or orientation of the model on which the measures of force or pressures are achieved. Transl. by M.W.R.

N66-14734# Microwave Associates, Inc., Burlington, Mass.
EXPLORATORY DEVELOPMENT ON COUPLING SCHEMES FOR PLASMA AMPLIFIERS Interim Technical Report, 1 Jun.–1 Sep. 1965
Charles S. Biechler Sep. 1965 30 p refs
(Contract AF 33(615)-3052)
(ITR-1; AD-623913) CFSTI: HC $2.00/MF $0.50

The properties of plasmas which are useful for coupling to beam-plasma amplifiers are discussed. The characteristics of PIG discharge plasmas are reviewed with emphasis on inhomogeneities. A method of solving Maxwell's equations in a right circular cylinder containing an axially inhomogeneous plasma is presented and the design of a universal coupling test vehicle is described. Author (TAB)

N66-14745# Texas Univ., Austin. Dept. of Physics.
THE PHYSICS OF METASTABLE SYSTEMS Final Report, Feb. 1, 1962–Jan. 31, 1963
W. W. Robertson [1963] 13 p refs
(Grant AF-AFOSR-62-270)
(AFOSR-65-1046; AD-622687) CFSTI: HC $1.00/MF $0.50

A technical resume of the results of investigation is given in the following categories: cross sections for the de-excitation of helium metastable atoms by collisions with atoms; reactions of the metastable helium triplets; metastable helium atom concentration in the earth's atmosphere; calculation of cross sections for zero activation energy processes by simple collision models with emphasis on the Penning effect; and interaction of a triplet and a normal helium atom. TAB

N66-14747# AVCO-Everett Research Lab., Everett, Mass.
BASIC STUDIES IN MAGNETOHYDRODYNAMICS Final Report
Richard M. Patrick Nov. 1964 18 p refs
(Contract AF 49(638)-1129)
(AFOSR-65-1207; AD-622701) CFSTI: HC $1.00/MF $0.50

In this investigation, the magnetic annular shock tube (MAST) is developed and used to study plasma phenomena important for collision free plasmas. Studies are carried out to bring the MAST to a state of development where it will become an established research tool. It is found that for a given shock velocity the shock tube must have a minimum length and that the plasma must be contained away from the walls of the tube, this being done by the use of magnetic fields. The annulus ratio and ablation are also important considerations in successful MAST operation. The plasma produced by the shock wave is collisionless in that the mean free path for ordinary collisions is large compared to the shock thickness. However, the importance of collisions in the shock front itself is not clear. Author (TAB)

N66-14776*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RADIAL DENSITY AND TEMPERATURE PROFILES AT THE ION CYCLOTRON WAVE RESONANCE POINT
Roman Krawec Washington, NASA, 1966 26 p refs Presented at the AIAA Plasma Dyn. Conf., Monterey, Calif., 2–4 Mar. 1966
(NASA-TM-X-52159) CFSTI: HC $2.00/MF $0.50 CSCL 20I

A simplified theory for an electrostatic probe in a magnetically confined plasma is presented. Interpretation of probe results using the model are compared with those calculated from Langmuir probe theory. The model presented provides an expression for calculating ion temperature from the probe data. Radial profiles of electron density, radial electric field, electron temperature, and ion temperature are presented for two experiments: (1) a d.c. hot-cathode low-pressure (2μ) discharge confined by a steady magnetic field; and (2) a plasma heating experiment where ion cyclotron waves propagate along the plasma column. The radial electron density profiles show that the maximum density does not occur on axis but at radii of 0.5 to 1.0 cm (the plasma radius was approximately 2.5 cm). The average densities are found to be in agreement with microwave interferometer measurements and consistent with the location of maximum power transfer. The ion and electron temperatures are found to reach a maximum near the plasma boundary. The addition of rf power is found to heat both the ions and electrons but has little effect on the density. Author

N66-14795# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
ELECTROPHORETIC POWER GENERATION IN THERMALLY IONIZED PLASMAS
C. C. Leiby, Jr. and J. C. Fields Oct. 1965 39 p refs *Its* Phys. Sci. Res. Paper No. 151
(AFCRL-65-739; AD-623788) CFSTI: HC $2.00/MF $0.50

Druyvesteyn's solutions for electrophoretically induced gas flows in electrical discharges in gases were extended over a larger pressure range and corrected for the influence of Debye shielding effects. The effects of molecular or 'slip' flow were also taken into account. These more accurate and general solutions were applied to the reverse phenomenon of space charge field

generation arising from the flow of a thermally ionized cesium plasma through a tube. Under such flow conditions, a nonlinear differential equation for the axial pressure distribution was obtained but not solved. However, it was possible to obtain estimates of the ranges of cesium pressure, temperature and tube radii which would be required for sensible levels of electric power generation. Anaphoretic flow power levels of the order of 0.1 to 10 watts, in tubes of laboratory dimensions (radii of 10 cm or less), appear feasible at temperatures from 1700° to 2400° K. Sensible power generation levels at lower temperatures require very large diameter tubes, and therefore are not feasible. Author (TAB)

N66-14892 Library of Congress, Washington, D. C. Aerospace Technology Div.
THE ENERGY OF BALL LIGHTNING
Arsen Iwanovsky *In its* Foreign Sci. Bull., Vol. 1, No. 12 Dec. 1965 p 19–22 refs (See N66-14887 05-34)

Attempts to estimate the amount of energy in ball lightning are considered. Because of the short duration and unpredictable behavior of ball lightning the resulting figures are inconclusive. A representative list of incidents in which ball lightning were involved is reported and discussed. Collisions between ball lightning and aircraft are among the incidents examined. M.R.W.

N66-14922# Air Force Cambridge Research Labs., Bedford, Mass. Microwave Physics Lab.
WAVE PHENOMENA IN IONIZED GASES
Richard E. Haskell and Robert J. Papa Aug. 1965 54 p refs *Its* Phys. Sci. Res. Paper No. 130
(AFCRL-65-641; AD-623789) CFSTI: HC $3.00/MF $0.50

The propagation of waves in uniform, unbounded magnetoplasmas is reviewed. Emphasis is placed on describing the various approaches and plasma models which may be used. The results and limitations of the different methods are discussed and compared. Dispersion curves for each model are presented in the form of ω-k plots. Author (TAB)

N66-14940 Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
MAGNETOHYDRODYNAMIC CHANNEL FLOW VELOCITY PROFILES AND ENTRY LENGTH
S. Sachs, W. D. Jackson, and G. A. Brown *In its* Res. on New Concepts in Energy Conversion 15 Aug. 1965 p 7–10 refs (See N66-14938 05-03) CFSTI: HC $2.00/MF $0.50

Preliminary experiments were conducted with magnetohydrodynamic (MHD) channel flows to determine MHD entry lengths from pitot tube measurements of velocity profiles. A cross-section view of the pitot tube apparatus is shown and a record of MHD velocity profile development is graphed. At an approximately constant Reynolds number, this profile flattens as the field is brought from downstream of the pitot tube to a location where the field interacts with the fluid. With the field downstream to the pitot tube, the profile is similar to the profile measured with no field. A measured profile at zero field and a computed one-seventh power law profile are also shown. While the accuracy of individual profile data is limited, the results do indicate the relative rate of profile development. M.W.R.

N66-14942 Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
CHARACTERISTICS OF A PURE ALKALI-METAL VAPOR PLASMA
J. L. Kerrebrock, M. A. Hoffman, and A. Solbes *In its* Res. on New Concepts in Energy Conversion 15 Aug. 1965 p 22–29 refs (See N66-14938 05-03) CFSTI: HC $2.00/MF $0.50

The alkali vapor is studied as a multicomponent system with aggregates of atoms and electrons characterized by mass and charge factors. A kinetic approach is used in dealing with states out of thermodynamic equilibrium; the space and time evolution of the distribution functions are governed by Liouville-type equations. Collision effects are shown in the usual way, with correlations between particle velocity and position neglected. A liquid-drop model is used when the aggregates of atoms is approximately 10. Except for drop–drop collisions, all collisions are taken into account; study of collisions with drops is made in a length scale characterizing the range of such interactions and taking a Maxwellian as a first approximation to the particle distribution functions. The evolution of successive moments of the Boltzmann equation is found. Experiments conducted with a dry potassium vapor indicate good agreement with theory except at high current densities; measured electrical conductivity is abnormally high at very low current densities. Supersaturation ratios as high as seven have been observed in a wet vapor; and at current densities of $\sim$1 amp/cm^2, voltages at the inlet of the test region increased because of condensation effect. M.W.R.

N66-14955*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
TRANSMISSION AND REFLECTION OF ELECTROMAGNETIC WAVES NORMALLY INCIDENT ON A WARM PLASMA Scientific Report No. 257
Craig Comstock 10 Dec. 1965 33 p refs
(Grant NsG-134)
(NASA-CR-69208) CFSTI: HC $2.00/MF $0.50 CSCL 20I

The solution for an electric field normally incident onto a warm, semi-infinite plasma is obtained by means of a modified Wiener–Hopf technique. The warm plasma is taken into account by means of the relativistic Vlasov equation. It is found that the previously obtained solution of Taylor gives the correct term for the wave number in the plasma, but not the correct answer for the field. It is shown that the method of considering an "equivalent" fully infinite plasma corresponds to a physically unrealistic matching of the plasma to the vacuum. The field inside the plasma and in the vacuum is found. The field just inside the plasma is obtained, and the non-uniform limit from warm to cold plasma found by Taylor is not found in our solution. Author

N66-14956*# AVCO-Everett Research Lab., Everett, Mass.
THE ELECTRON PLASMA—EXPERIMENT THEORY AND APPLICATIONS
R. H. Levy and G. S. Janes Jun. 1965 25 p refs
(Contracts NASw-1101; AF 49(638)-659)
(NASA-CR-69205; AMP-160) CFSTI: HC $1.00/MF $0.50 CSCL 20I

The basic concepts involved in the production and control of pure electron and electron rich plasmas are reviewed, with particular reference to the different geometries in which equilibrium may be achieved. An inductive method of establishing arbitrary equilibrium profiles is described. Recent theoretical work on the stability of some particularly simple equilibria is then discussed. Instabilities considered are: (1) The so-called diocotron (or slipping stream) instability, this instability (whose importance in magnetron work is well understood) is related to the Kelvin–Helmholtz instability in fluid mechanics. (2) A new mode involving spontaneous coherent radiation into space as a result of bunching. This effect can be described as the flexible antenna instability. Author

N66-15067*# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
EXPERIMENTAL AND THEORETICAL RESEARCH ON PLASMA SHEATHS AND BOUNDARY LAYERS AROUND STAGNATION POINT ELECTRODES Semiannual Progress Report No. 2, 1 Jan.–30 Jun. 1965
Michael Ming Chen [1965] 19 p refs
(Grant NsG-724)
(NASA-CR-69136) CFSTI: HC $1.00/MF $0.50 CSCL 20I

It is reported that the construction of an experimental apparatus was essentially completed, and that considerable effort was devoted to calibrating and debugging the apparatus. The result is that the arc jet is virtually contamination free and steady state. Preliminary data were obtained in terms of spectrum, probe, and electrode characteristics, and a modest theoretical analysis was initiated. C.T.C.

N66-15095# California Univ., Livermore. Lawrence Radiation Lab.
COMPRESSION OF MAGNETIC FIELD INSIDE A HOLLOW EXPLOSIVE-DRIVEN CYLINDRICAL CONDUCTOR
Ray E. Kidder 27 Jul. 1965 29 p refs Presented the Conf. on Megagauss Magnetic Field Generation by Explosives and Related Expt., Rome, 21–23 Sep. 1965
(Contract W-7405-ENG-48)
(UCRL-14349; CONF-650937-1) CFSTI: HC $2.00/MF $0.50

Detailed numerical calculations of a flux compression experiment were performed with a one-dimensional magnetohydrodynamics code written for the IBM 7094 computer. Calculated peak magnetic fields of 10–14 megagauss are obtained in approximate agreement with experimental results. The equation of state used to describe the copper liner takes explicit account of the liquid–vapor transition. The temperature coefficient of resistivity of the condensed phase is assumed to be constant and equal to one or three-times the observed value at 1500° C. The effect of the finite resistivity of the vapor phase and of the pressure-dependence of the resistivity of the condensed phase is investigated and found to be small. The distribution of temperature and magnetic field in the liner is described. It is noted that the attainment of large peak magnetic fields requires an implosion with a high degree of cylindrical symmetry to achieve the necessary convergence. Author (NSA)

N66-15179# Polytechnic Inst. of Brooklyn, N. Y.
RESEARCH ON ELECTROMAGNETICS FOR PROJECT DEFENDER Semiannual Technical Summary, Period Ending 30 Sep. 1965
Ernst Weber 30 Sep. 1965 212 p refs
(Contract Nonr-839(38); ARPA Order 529; Proj. Defender)
(PIBMRI-1295.1-65; AD 623718) CFSTI: HC $5.00/MF $1.25

Progress is reported on a fairly large number of projects dealing generally with electromagnetic phenomena in plasmas and plasma-like media, such as the properties of antennas, excitation of electromagnetic waves in plasmas, coupling of acoustic and electromagnetic waves, propagation through time-varying random media, electron densities in shock waves, basic kinetic theory of ionized media, instabilities in plasmas, and properties of laboratory type plasmas. A smaller group of projects deals with characteristics of transmitters and receivers for communication through randomly time-varying media and with the problem of pattern recognition. Author (TAB)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N66-14434# Mithras, Inc., Cambridge, Mass.
TRANSITION METALS IN $LaAlO_3$ Scientific Report No. 1
Charles S. Naiman, Jack Schwartz, and Arthur Linz Jul. 1965 28 p refs
(Contract AF 19(628)-4006)
(AFCRL-65-619; MC-64-102-R1; AD-623121) CFSTI: HC $2.00/MF $0.50

Optical absorption and EPR studies have been made of Cr and Co in $LaAlO_3$ grown by flame fusion. Crystal field values have been established as follows: $Dq/B = 3.18$ for Cr^{3+}, 0.965 for Co^{2+}, and 3.08 for Co^{3+} in $LaAlO_3$. Local site symmetries for the two dopants, as observed by EPR, are discussed. Author (TAB)

N66-14467# Massachusetts Inst. of Tech., Cambridge. Crystal Physics Lab.
GROWTH AND STUDY OF CERTAIN PEROVSKITE-STRUCTURE LASER HOST CRYSTALS Semiannual Status Report, Apr. 1–Oct. 1, 1965
A. Smakula et al 22 Oct. 1965 12 p
(Contract Nonr-3963(20))
(AD-623511) CFSTI: HC $1.00/MF $0.50

Progress is described for work involving the crystal growth, lattice constant and density determination, and UV absorption edge measurement of magnesium potassium fluoride; and the flux growth and plasma torch growth of barium zirconate. TAB

N66-14533# Corning Glass Works, N. Y.
GLASS LASER RESEARCH Semiannual Report, Dec. 1964–15 Jul. 1965
R. D. Maurer, M. E. Vance, G. E. Stong, N. F. Borrelli, S. D. Sims et al 15 Aug. 1965 91 p refs
(Contract Nonr-3833(00); Proj. Defender)
(AD-623309) CFSTI: HC $3.00/MF $0.75

The report presents additional data on the properties of glass used in lasers as well as operating characteristics of glass lasers. The effect of intense ultraviolet radiation is shown to decrease the output of glass lasers much more than can be accounted for the decrease in fluorescence intensity or absorption of pump light. Comprehensive threshold and output data are given for several lasers of Code 0580 glass. These data can be approximately described by the theory of Miles and Goldstein using an internal oscillator loss only slightly higher than the measured static loss in the glass. Gain data of a glass laser amplifier show the difference between a glass laser probe and a narrow band probe with respect to averaging over the fluorescence line. Finally, quantitative measurements of the birefrigence following pumping are given. Author (TAB)

N66-14590# Westinghouse Electric Corp., Pittsburgh, Pa.
GROWTH AND CHARACTERIZATION OF SINGLE CRYSTALS OF RARE EARTH COMPOUNDS
[1965] 8 p
(Contract AF 49(638)-1245)
(QTR-9; AD-622798)

The electrical resistivities of the intra-rare-earth alloys of dysprosium have been determined at 4.2, 77, and 296K for a

continued study of the impurity scattering of the conduction electrons. The resistivity data reveal that substitution of La, Ce, Pr, Nd, and Sm in Dy leads to considerable increases of the residual resistivity of Dy at low temperatures, but the increases disappear at 296K. The impurity-induced resistivities are predominantly due to the exchange scattering of the electrons via the Ruderman-Kittel type exchange interaction between the 4f and conduction electrons. The exchange scattering is shown to depend only on the difference between the atomic spins of the solvent and solute ions, with the spin-orbit coupling playing an insignificant role. Neutron diffraction studies of the CrTe-CrSb solid solutions have revealed the formation of a canted spin structure in the pseudo-binary system with cosine of the cant angle varying as a linear function of the composition. Work was continued on the electrical properties of EuS single crystals, Si-doped $CrBr_3$, and dilute alloys of Pd and Al containing Gd. A magnetic study was initiated of Mn_3ZnC. TAB

N66-14594# Oklahoma State Univ. Research Foundation, Stillwater.
OPTICAL AND ELECTRICAL PROPERTIES OF STANNIC OXIDE CRYSTALS Technical Status Report No. 28, 1 Jul.–30 Sep. 1965
E. E. Kohnke Oct. 1965 13 p ref
(Contract Nonr-2595(01))
(AD-622703) CFSTI: HC $1.00/MF $0.50

The report contains summaries of research on stannic oxide crystals in the following areas; reflectivity, band structure, high temperature conductivity, thermoelectric power, and photoconductivity. TAB

N66-14595# Brown Univ., Providence, R. I.
MATERIALS SCIENCES PROGRAM Fourth Annual Technical Report, 1 Jul. 1964–30 Jun. 1965
[1965] 118 p refs
(Contract ARPA SD-86)
(AD-622774) CFSTI: HC $4.00/MF $0.75

Fields of materials research at Brown University includes: Theoretical studies of mechanical behavior of elastic and viscoelastic materials; Experimental studies of nonlinear viscoelastic behavior and of fracture in polymers and glasses by stress wave loading; Studies of crystal defects, their origin and their interactions; Propagation of high-frequency stress waves in solids; Studies of structures and molecular forces in crystals by spectroscopy from X-ray to sub-audio frequencies; Electron and nuclear spin resonance studies of inorganic crystals and complexes; Phase transitions and rate processes in polymers and glasses from molecular theory and experiment; Studies in mechanics of solids ranging from response of structural elements to macroscopic evaluation of microscopic behavior; Physical metallurgy and corresponding studies of ionic crystals and ceramics; Electrical properties of semiconductors especially as affected by radiation; Deformation of isotropic materials, crystals, and aggregates under geological conditions and in model systems; Stability of crystalline materials in relation to temperature, pressure and chemical composition, and as affected by ion exchange and gaseous diffusion; Properties of matter at a very low temperatures; theory of superconductivity and related many-body problems; Surface state physics and electron microscopy; Paramagnetic resonance in solids, acoustic and hydrodynamic studies of solids and liquid metals. TAB

N66-14746# Westinghouse Electric Corp., Pittsburgh, Pa. Westinghouse Research Labs.
BASIC STUDIES ON THERMOELECTRIC MATERIALS Quarterly Report, Sep. 28–Dec. 27, 1964
Jan. 1965 72 p refs
(Contract NObs-90444)
(QR-13; AD-622381) CFSTI: HC $3.00/MF $0.75

Work was performed on a number of materials of thermoelectric interest. Although some of the work involves a study of a large number of compounds, the major interest in all work has been a better understanding of the properties of materials and the interrelations between the transport properties of interest in thermoelectric applications and the fundamental properties of the material such as the valence electron density and the crystal structure. Materials which have been studied are PiSb, GeTe, and a wide class of materials having pyrite or marcasite structures. TAB

N66-14803# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
BASIC STUDIES ON THERMOELECTRIC MATERIALS Quarterly Report, Dec. 28, 1964–Mar. 28, 1965
Apr. 1965 85 p refs
(Contract NObs-90444)
(QR-14; AD-622382) CFSTI: HC $3.00/MF $0.75

Platinum antimonide was investigated with emphasis on measurements of thermal conductivity. A study of the $GeTeTlBiTe_2$ system contributed to the understanding of the mechanical properties of GeTe and enabled the production of materials with a high figure of merit and better mechanical properties. Attempts were made to measure the anisotropy of the thermal conductivity of selenium, but no results have been obtained so far. The conditions under which Ettingshausen and magnetically enhanced Peltier effect devices have sufficiently high performance to be useful were investigated. A general review of the theory of thermal conductivity in solids was written. TAB

N66-14809# Army Electronics Labs., Fort Monmouth, N. J.
ANNEALING EFFECTS ON MICROSTRUCTURE AND DIELECTRIC PROPERTIES OF HOT-PRESSED, ULTRAFINE GRAINED $BaTiO_3$
R. J. Brandmayr, Arthur E. Brown, and Annie M. Dunlap May 1965 37 p refs
(ECOM-2614; AD-622970) CFSTI: HC $2.00/MF $0.50

Dense barium titanate bodies with a grain size of 0.05 micron have been prepared by hot-pressing high purity material at temperatures as low as 1475F. The dielectric properties of this material and also for samples which have been annealed to grow larger grains are reported. Data which show the variation in dielectric constant and temperature stability with increasing grain size from 0.05 micron to about 6 microns are included. The dielectric constant reaches a maximum at a grain size of about 1 micron. Author (TAB)

N66-14810# Army Electronics Labs., Fort Monmouth, N. J.
CHEMICALLY DEPOSITED FERRITE FILMS AS NONRECIPROCAL ELEMENTS IN AN EXPERIMENTAL RESONANCE ISOLATOR
Richard Stern, William L. Wade, Jr., Thomas Collins, and William J. Skudera, Jr. Aug. 1965 20 p ref
(ECOM-2622; AD-622779) CFSTI: HC $1.00/MF $0.50

Nickel, nickel zinc, and magnesium zinc ferrite thin films have been prepared singly and in combination utilizing chemical deposition techniques. These films, deposited on alumina substrates were then tested as nonreciprocal elements in an experimental resonance isolator in the 35 Gc frequency region. Device performance as well as the magnetic properties and crystallographic analysis is included. Author (TAB)

N66-14812# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
BASIC STUDIES ON THERMOELECTRIC MATERIALS Quarterly Report, Apr. 1–Sep. 27, 1964
Oct. 1964 109 p refs
(Contract NObs-90444)
(QR-12; AD-622380) CFSTI: HC $4.00/MF $0.75

Studies of the band structures and transport properties were made of bismuth telluride, platinum antimonide, and selenium. TAB

N66-14853# Naval Research Lab., Washington, D. C.
STRUCTURE IN TEXTURED GOLD FILMS Final Report
J. E. Davey and R. H. Deiter 4 Sep. 1964 23 p refs
(NRL-6121; AD-606827) CFSTI: HC $1.00/MF $0.50

Gold films deposited by evaporation onto amorphous substrates at a wide variety of temperatures were examined by x-ray and electron-reflection diffraction, as well as by resistivity measurements. It was found that: (a) the (111) texture predominates at all deposition temperatures and appears almost exclusively between 370 and 500C; (b) the hexagonal partial structure, first noted by others in cold-worked bulk gold, appears in electron diffraction in this temperature range, along with the forbidden (110) reflection; (c) the deposition process introduces large concentrations of vacancies, which cluster under annealing into quite stable complexes. A large observed increase in resistivity and contraction of the lattice as measured by x-ray diffraction are related to these vacancies. Author (TAB)

N66-14907*# Oklahoma State Univ., Stillwater.
A PRELIMINARY STUDY OF CERTAIN ELECTRICAL PROPERTIES OF STANNIC OXIDE CERAMICS
H. E. Mathews and E. E. Kohnke Washington, NASA, Jan. 1966 41 p refs
(Grant NsG-609)
(NASA-CR-376) CFSTI: HC $2.00/MF $0.50 CSCL 20L

A preliminary study has been made of stannic oxide ceramic bodies. Areas considered were (1) development of fabrication techniques, (2) evaluation of several optical and electrical measurements that might be useful in characterizing basic material parameters, and (3) correlation of these parameters with bulk and surface effects previously found in grown stannic oxide crystals. In addition to producing a method for fabricating stannic oxide ceramic specimens, this survey identified several experimental methods that appear to be particularly appropriate for use in probing basic surface and bulk material properties. One special class of measurements (a study of imperfection properties using photoelectronic techniques) was shown to be exceptionally promising for this purpose. Suggestions for quantitative studies are given. Author

N66-14941 Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
THERMIONIC EMISSION FROM A TUNGSTEN MONOCRYSTAL IN OXYGEN
W. Engelmaier and R. E. Stickney *In its* Res. on New Concepts in Energy Conversion 15 Aug. 1965 p 11–21 refs (See N66-14938 05-03) CFSTI: HC $2.00/MF $0.50

Carbon purities are found to have no influence on the work function of tungsten filaments; and the Richardson constant decreases only slightly after oxygen treatment of the filament. Adsorption of oxygen produces the expected decrease in emission, but such changes are not as strongly dependent on crystallographic direction as in the case of cesium on tungsten. A schematic diagram is shown of the tube and the circuit used for the measurements. Richardson plots are graphed for the 111 and 100 crystallographic direction in vacuum and in 1×10^{-6} torr oxygen before and after oxygen treatment; and emission maps are included for various pressures at different temperatures. Effective work function for various crystallographic directions is plotted as a function of (1) filament temperature and oxygen pressure and (2) the ratio of filament temperature to effective reservoir temperature. M.W.R.

N66-15014# American Meteorological Society, Boston, Mass.
THE FORMATION OF F-CENTERS IN SOLID SOLUTIONS OF KCl—KBr [K OBRAZOVANIIU F-TSENTROV V TVERDY RASTVORAKH KCl—KBr]
I. Ia. Melik-Gaikazian and D. I. Vaisburd Bedford, Mass., AFCRL, Sep. 1965 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), no. 6, 1962 p 174–176
(Contract AF 19(628)-3880)
(T-R-452; AD-621420) CFSTI: HC $1.00/MF $0.50

The relationships of F-center concentration in KCl–KBr solid solutions to x-ray exposure and to solid solution percentage composition were determined. The typical concentration vs. exposure plot shows a rapid nonlinear initial growth of F-centers, followed by a slow linear growth. F-center concentration was found to decrease nearly additively with increasing KBr content. TAB

N66-15023# Carnegie Inst. of Tech., Pittsburgh, Pa. Dept. of Electrical Engineering.
nGe–pGaAs HETEROJUNCTIONS Interim Technical Report
Arthur R. Riben Feb. 1965 176 p refs
(Contract DA-31-124-ARO(D)-131)
(AROD-3397-7; AD-622961)

This thesis presents a model which includes the effect of carrier tunneling through the forbidden energy region of the semiconductors, and shows that the experimental characteristics of nGe–pGaAs hetereojunctions are explained by recombination-tunneling mechanisms, which are different for the forward and reverse directions. The predominance of the tunneling current over the thermal current in nGe–pGaAs devices is shown to be the result of a large energy discontinuity between the valence bands of the two materials. The methods of fabricating these heterojunctions are discussed, and it is shown that the electrical characteristics are related to the original substrate preparation. The work indicates that growths on cleaved substrates will have the smallest number of interface defects, and thus the subsequent devices will have the lowest current densities. Injection studies were also carried out on many devices, and the results were consistent with the existence of a majority carrier tunneling mechanism as the predominant cause of charge transport. A conclusion drawn from this work is that in order to further study the possibility of obtaining increased emitter injection efficiency by means of a wide bandgap emitter transistor, the base material should be of the conductivity type such that the minority carriers are in the energy band which has the smaller discontinuity. Author (TAB)

N66-15045 Joint Publications Research Service, Washington, D. C.
OPTICAL MASER OF Nd^{3+} IN $CaWo_4$
Shun-fu Liu, Ch-en Hsi, Pao-ken Liang, Yung-k'ai Huang, Shih-ying Li et al *In its* Transl. on Communist China's Sci. and Technol. 6 Dec. 1965 6 p refs Transl. into ENGLISH from K'o-Hsueh T'ung Pao (Peking), no. 9, 20 Sep. 1965 p 827–829 (See N66-15042 05-34) CFSTI: $3.00

Crystals of $CaWo_4$ containing trivalent neodymium were prepared in a platinum–rhodium crucible, annealed for eight hours at 1,350° C, and evaluated for their optical characteristics. C-axis crystals had a photon emission spectral line of 1.065 micrometers, and a-axis crystals had a 1.058 micrometer spectral line. Both showed the strongest emission line of 1.0651 micrometers at liquid nitrogen temperatures. Crystals of 3 to 5 mm diameter were made into Fabry-Perot optical frequency resonators for stimulated light experiments and their output energy data were obtained by radiation detector. Oscillograms for different energy inputs showed that neodymium ions in a tungstate crystal field produced a quadruple-energy level maser oscillation system of very good characteristics. G.G.

N66-15063*# Hawaii Univ., Honolulu.
SOME INTENSITY MEASUREMENTS IN THE VACUUM ULTRAVIOLET
K. Watanabe, F. M. Matsunaga, and R. S. Jackson Jun. 1964 65 p refs
(Grant NsG-328)
(NASA-CR-58429) CFSTI: HC $3.00/MF $0.75 CSCL 20L

Photoelectric yields of twenty-three untreated metals, including gold black, and four semiconductors were measured in the region 900 to 2000 Å by means of a calibrated thermocouple. The yield curves showed no structure and in general confirmed previous results for several metals. The yields were usually reproducible in the region 1300 to 2000 Å. Results for several heat-treated samples also confirmed previous data. The photoionization yield of xenon as determined by a thermocouple was found to be unity in the spectral region 850 to 1022 Å which includes a number of broad preionized lines. Measurements were made at 230 wavelengths. The photoionization yield of nitric oxide was determined at 470 wavelengths in the region 850 to 1345 Å with improved resolution. At Lyman alpha the yield was found to be 78 ±5% in agreement with the previous recommended value of 81%. Author

N66-15073# Portugal. Nuclear Energy Commission, Sacavém. Physics Div.
THE PHONON FREQUENCY DISTRIBUTION OF VANADIUM
W. Gläser, F. Carvalho, and G. Ehret 1964 18 p refs Presented at Symp. on the Inelastic Scattering of Neutrons, Intern. Atom Energy Agency, Bombay, 15–19 Dec. 1964 Work performed at the Inst. für Angew. Kernphys. Kernforschungszentrum, Karlsruhe, W. Germany
(LFEN.33(β)) CFSTI: HC $1.00/MF $0.50

The phonon frequency distribution of vanadium has been measured several times using the beryllium filter time-of-flight method. But there have been objections against this method; for instance it does not start with monochromatic neutrons and multiphonon processes are corrected only in a crude way. In the present work it was tried to get this frequency distribution by a method which covers a larger part of the energy transfer-momentum transfer plane. Using the rotating crystal time-of-flight spectrometer with incident neutron energies between 0.018 and 0.08 eV, energy transfers in the range from 0 to 2 k_BT and Q-values between 0 and 14 $Å^{-1}$ (where h Q is the momentum transfer) were measured. Scattering law values were calculated and the frequency distribution was determined with the extrapolation method proposed by Egelstaff, in an iterative way with the help of LEAP calculations. With the experimental errors the results agree very satisfactorily with the cold neutron work for energy transfers greater than $0.5k_BT$. Below $0.5k_BT$ an additional peak is found, the origin of which is not yet explained. Results are discussed and compared with existing theoretical calculations. Author

N66-15114 Catholic Univ. of America, Washington, D. C. Dept. of Electrical Engineering.
ULTRASONIC STUDY OF CHROMIUM NEAR THE NEEL TEMPERATURE
Edward J. O'Brien and Jude E. Franklin *In its* Elec. Eng. Res. Rev., No. 4 Jun. 1965 p 15–20 refs (See N66-15112 05-34)

Investigations are being conducted on the dynamics of the coupling between mechanical stresses and the magnetic alignment of chromium using ultrasonics. Measurements of the attenuation (a) and the velocity of ultrasonic waves in the frequency range 15 to 85 mc/sec are being made near the Neel temperature (T_N), which is about 38° C. Results show that (1) a increases linearly with frequency for $T > T_N$; (2) a increases with frequency for $T < T_N$, but the linearity is not as well defined as in the range $T > T_N$; and (3) a appears to rise and fall too abruptly with temperature to be fitted to a simple power law of the form: $a = \frac{A}{(T - T_N)^n}$. It appears that for $t > t_N$, a displays a Gaussian dependence on temperature: $a = K_{exp}(\beta(T - T_c)^2)$ where T_c is very close to 38.25° C. Fact (1) might be explained by the phonon-spin interaction theory of Papoular, which predicts an attenuation linear with frequency for $T > T_N$, but may not apply completely since it assumes nonconducting anti-ferromagnetics. Fact (2) may indicate two loss mechanisms. Fact (3) may be attributable to a Gaussian distribution in local Neel temperature which could smear out an even sharper attenuation peak and override the expected $a = \frac{A}{(T - T_N)^n}$ dependence. R.N.A.

N66-15119 Catholic Univ. of America, Washington, D. C. Dept. of Electrical Engineering.
PHENOMENOLOGICAL THEORY OF POLARIZATION REVERSAL IN FERRIELECTRIC $Bi_4Ti_3O_{12}$ SINGLE CRYSTALS
Charles F. Pulvari and Antonio S. de la Paz *In its* Elec. Eng. Res. Rev., No. 4 Jun. 1965 p 57–86 refs (See N66-15112 05-34)
(Contract AF 33(657)-10454)

This study was conducted to find a phenomenological theory describing switching behavior of ferrielectrics and to relate switching current i, switching field E, and the time of switching t in an expression $i = f(E,t)$ with which the various dynamic parameters of polarization reversal such as switching current i, switching time t, and switching resistance R_s could be derived. The physical constants in the equation $i = f(E,t)$ are the field of activation and the displacement velocity of domains per volt. These are shown to be related to coercivity and mobility. Single domain $Bi_4Ti_3O_{12}$ single crystals were used without any impurity additions, and were grown by the best crystallization conditions available. The electrode area of the samples was $3.82 \times 10^{-3} cm^2$. Sample thickness varied between 5×10^{-3} and $12 \times 10^{-3} cm^2$. Data was taken in the pseudo-tetragonal phase at room temperature. Impurities were found to affect coercivity and mobility. The satisfactory agreement between theory and measurement provided a better understanding of this effect. R.N.A.

N66-15153 Joint Publications Research Service, Washington, D. C.
THE DEVELOPMENT OF SEMICONDUCTORS
Shou-Wu Wang *In its* Transl. on Communist China's Sci. and Technol., No. 274 5 Jan. 1966 p 13–16 (See N66-15151 05-34) CFSTI: $3.00

An historical approach is taken to a brief review of semiconductor materials. Solid state electronic equipment is mentioned as are crystal development, chemical conductors, and purity requirements. M.W.R.

N66-15174# Harvard Univ., Cambridge, Mass. Cruft Lab.
SPIN WAVE INSTABILITIES AND RELAXATIONS IN FERROMAGNETIC METALS Technical Report No. 485
James B. Comly Aug. 1965 257 p refs *Its* Sci. Rept.-5 (Ser. 3)
(Contracts AF 19(628)-3874; Nonr-1866(16))
(AFCRL-65-613; AD-623164) CFSTI: HC $6.00/MF $1.25

The first useful measurements of parallel-pumped instability (PPI) thresholds in metals were made on vacuum-deposited films and rolled foils of the nickel–iron alloy, permalloy, using a pulse-power modulation of the usual electron paramagnetic resonance field modulation signal recovery technique. It is shown that PPI signals can be observed in films thinner than microwave skin depth, and in polycrystalline foils many skin depths thick. Relaxation rates of spin waves are determined. TAB

N66-15183# MSI Electronics, Inc., Richmond Hill, N. Y.
BURNOUT RESISTANT X BAND HOT CARRIER DETECTORS Quarterly Report, 1 Jul.–3 Sep. 1965
D. Scaringella and C. Shulman 15 Oct. 1965 17 p
(Contract DA-28-043-AMC-01395(E))
(QR-1; AD-624115) CFSTI: HC $1.00/MF $0.50

Measurements were performed on .004 inch dia. N Type silicon hot carrier detectors. These detectors were 3 to 14 db less sensitive than that predicted by theoretical analysis. Some detectors exhibited a reversal in polarity when the RF power incident on the detector was increased from minimum detectable signal to approximately 10 mw. The rectification phenomena exhibited by these devices can, in some instances, be related to the static E-I characteristics, but generally static considerations are not enough. All hot carrier diodes exhibited some degree of non-linearity. Efforts are being made to detect the sources of non-linearity with the objective of establishing the relationship, if any, between rectification and static characterization. Author (TAB)

N66-15189# International Business Machines Corp., Yorktown Heights, N. Y. Thomas J. Watson Center.
PHONON INTERACTIONS IN CRYSTALS Quarterly Progress Report, 15 May–14 Aug. 1965
N. S. Shiren, M. Pomerantz, and R. J. von Gutfeld [1965] 35 p refs
(Contract DA-36-039-AMC-02280(E))
(QTR-9; AD-623865) CFSTI: HC $2.00/MF $0.50

Measurements of parametric up-conversion in TiO_2 show a large anisotropy of the third order elastic constants. A theory of signal velocity for both emission and absorption is presented. Attenuation of microwave phonons due to In impurities in Ge were observed to be similar to that caused by Ga impurities. This was expected from a proposed theory of attenuation by acceptors, although the experimental results are not yet completely understood. Measurements were made of the attenuation of x-band phonons in YIG, and Ga substituted YIG, as a function of temperature. Heat pulses were observed in two more carefully grown single crystals of tin, but, as before, the heat flow was principally a diffusive one with a resulting electron mean free path of 0.005 cm. The thermal relaxation time of thin indium films were measured as a continuous function of temperature. For indium on sapphire, this relaxation time seems to be independent of temperature from 4° K to 300° K. Author (TAB)

N66-15195# Library of Congress, Washington, D. C. Aerospace Technology Div.
MATERIALS FOR HIGH-TEMPERATURE ENERGY CONVERTERS Surveys of Soviet Scientific and Technical Literature—Annotated Bibliography
Michael Slesarenko 9 Dec. 1965 37 p refs
(ATD-65-112)

An annotated bibliography of 93 Soviet monographs on high temperature energy converters is presented. Studies related to this field are also listed. The data were compiled from open source materials available at the Aerospace Technology Division and the Library of Congress, and cover the years 1955 through 1960. Translations and English abstracts are indicated when available, and an author index is included. M.G.J.

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N66-14497# Weapons Research Establishment (Australia).
EVALUATION OF HIGH TEST PEROXIDE DENSITY FROM CONCENTRATION AND TEMPERATURE
J. R. Bentley and R. H. Weldon Dec. 1964 20 p refs
(WRE-TM-TRD-72) CFSTI: HC $1.00/MF $0.50

A set of curves for the density of high test peroxide at concentrations between 84% and 89% and temperatures between 0° C and 30° C were constructed. In addition, a nomogram was constructed to enable the density to be more easily and accurately determined from temperature and concentration data. Author

N66-14560# Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF LAMINATED SOLID PROPELLANTS Final Technical Report 15 Apr. 1961–30 Nov. 1963
Alfred Rudnick, Robert A. King, James L. Harp, Delbert H. Fisher, Bailey Bennett et al 30 Nov. 1963 52 p
(Contract Nonr-3506(00)(FBM))
(G-4890-1; AD-622399) CFSTI: HC $3.00/MF $0.75

The concept of reinforcement of a solid-propellant grain through use of combustible metal or plastic laminates is discussed. Procedures used for preparing test samples for mechanical property studies and firing tests are described. Mechanical strength was found to be increased generally in proportion to the amount of reinforcement added. Firing tests demonstrated clearly that the orientation of the reinforcement layers parallel to the combustion surface is not compatible with satisfactory combustion, whereas, when the reinforcement is oriented normal to the combustion surface, buring is either enhanced or unchanged. Author (TAB)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N66-14371# Aeronautical Research Labs., Melbourne (Australia).
A DEBRIS GUARD FOR TURBINE ENGINES
R. Licciardo Feb. 1965 15 p
(ARL/ME-265) CFSTI: HC $1.00/MF $0.50

Design principles and test procedures are discussed for a debris guard for aircraft turbine engines. Consisting of two rows of aerofoils in staggered formation, the guard is intended primarily to prevent penetration by hard materials large enough to do damage and is also considered suitable protection against birds. Stone firing, pressure loss, and engine tests indicate that effective protection against ingestion of solid debris can be achieved with comparatively little pressure loss. The geometric arrangement employed is very sturdy and permits simple de-icing measures. Results obtained indicate that the guard is ready for use in actual flight evaluation studies. M.W.R.

N66-14558# Atomics International, Canoga Park, Calif.
EIGHTH AFOSR CONTRACTORS' MEETING ON ION AND PLASMA PROPULSION RESEARCH Summaries of Research
[1965] 43 p refs Meeting held at Los Angeles, 29–30 Apr. 1965
(Contract AF 49(638)-1222)
(AL-65-77; AFOSR-65-1266; AD-622527) CFSTI: HC $2.00/MF $0.50

A bibliography of research, including abstracts, is given on ion and plasma propulsion research. TAB

N66-14566# Sundstrand Aviation-Denver, Denver, Colo.
EFFECT OF BACK PRESSURE ON RE-ENTRY TURBINE PERFORMANCE Final Report
Robert G. Adams and James E. Mullaney 13 Mar. 1964 99 p refs
(Contract Nonr-2292(00))
(CDRD64-7033; AD-622392) CFSTI: HC $3.00/MF $0.75

The intent was to investigate experimentally the influence of back pressure (Reynolds Number effect) on the stage performance and overall performance of a two-stage re-entry type turbine, to analyze and correlate these data, where possible, with existing theories and to attempt a loss analysis which will separate the viscous losses from the non-viscous losses. For these tests, existing turbine hardware was to be used with only minor changes. The investigations were intended to be of exploratory nature registering the gross effects and main trends of the back pressure influence at supersonic as well as sonic approach velocities to the rotor. TAB

N66-14592# Thiokol Chemical Corp., Denville, N. J. Reaction Motors Div.
RESEARCH STUDY OF LIGHT EMISSION CAUSED BY PRESSURE FLUCTUATIONS IN ROCKET ENGINES Final Report, 1 Jan.–31 Dec. 1964
B. Hornstein May 1965 85 p refs
(Contract AF 49(638)-1279)
(RMD-5516-F; AFOSR-65-1208; AD-622524) CFSTI: HC $3.00/MF $0.75

Simultaneous high frequency measurements of light emission and pressure were made in an oscillating premixed methane-air, 3 inch i. d. X 16 inch long rocket engine at pressures from 50 to 150 psig. Using filtered photomultiplier tubes, emission in the OH (0,0) band (3064A), the CH (0,0) band (4315A), and total luminosity ($CO + O = CO_2 +$ photons) over the range of the 1P28 phototube were monitored. Depending on injector arrangement, longitudinal oscillations of nominally 1150 cps and transverse oscillations of mainly 7100 cps and 14,000 cps (1st tangential and 1st radial) were encountered. With transverse oscillations, no corresponding emission fluctuations were observed, which may be owed to the aspect angle of the detectors, 90° to the engine axis (0° to the plane or pressure propagation). The longitudinal pressure oscillations were always accompanied by emission fluctuations of the same frequency. Emission from the chain-branching radicals OH and CH lagged the pressure by about .2 milliseconds except at 150 psig where the lag was zero. At 50 and 100 psig, the total luminosity was in phase with pressure. Visible spectra were photographically recorded, and showed similarity to previous laboratory spectra of flames as a function of pressure. TAB

N66-14674# France. Office National d'Etudes et de Recherches Aerospatiales.
ACTUAL POSSIBILITIES OF THEORETICAL STUDY OF A SUPERSONIC TWO STREAM NOZZLE [POSSIBILITES ACTUELLES D'ETUDE THEORIQUE D'UNE TUYERE SUPERSONIQUE A DOUBLE FLUX]
Jean-Marie Hardy and Jean Delery 1965 37 p refs In FRENCH Presented at the AGARD Meeting of Specialists on the Aerodyn. of Propeller Units, A.E.D.C., Tullahoma, Tenn., 25–28 Oct. 1965
(TP-287) CFSTI: HC $2.00/MF $0.50

A method is given for calculating the performance of a two stream exhaust nozzle, with either weak or strong secondary flow. The calculations show agreement with experimental results where the fluid has the same temperature as the surrounding air. For a real gas, the method demonstrates the importance of temperature and specific heat as factors in the calculation of performance in the case of strong secondary flow. Transl. by D.T.

N66-14701*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MANNED MARS LANDING MISSIONS USING ELECTRIC PROPULSION
John S. Mac Kay, Charles L. Zola, Leonard G. Rossa, Laurence H. Fishbach, William C. Strack et al Washington, NASA, Jan. 1966 31 p refs
(NASA-TN-D-3194) CFSTI: HC $2.00/MF $0.50 CSCL 21C

Estimates of initial mass required in low Earth orbit to land four men of a seven-man crew on Mars are presented for a number of mission profiles for a time span of between 400 and 700 days. Initial mass was evaluated as a function of mission time; payload estimates included weight allowances for shielding the crew against solar flares, cosmic rays, and the Earth's inner Van Allen belt. An initial high altitude rendezvous maneuver prior to Earth escape was found essential for reduction of shielding weight requirements and time that the crew is away from Earth. A mission profile with atmospheric braking at Earth return, coupled with unmanned traversal of the Van Allen Belts, was used for several sensitivity studies; results showed that most of the weight penalty is due to thrustor inefficiency. The importance of recovery from radiation for the crew was pointed out. Comparisons of all-electric, and nuclear or chemical propulsion systems found a combined system of nuclear-electric propulsion superior to both, the all-nuclear and the all-electric systems. G.G.

N66-14706*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INVESTIGATION OF HYDROTEST FAILURE OF THIOKOL CHEMICAL CORPORATION 260-INCH-DIAMETER SL-1 MOTOR CASE
John E. Srawley and Jack B. Esgar Washington, NASA, Jan. 1966 105 p refs
(NASA-TM-X-1194) CFSTI: HC $3.00/MF $1.00 CSCL 21H

Failure of a 260-inch diameter solid propellant rocket motor case during hydrostatic testing at a pressure of 542 pounds per square inch was traced to defects in longitudinal arc welds

on the cylindrical section of the motor case. The area where the defects were located had been repaired by manual gas-tungsten welding, and nondestructive testing prior to aging did not detect the weak spots. Limited tests with radiographic and ultrasonic methods for detecting tight fatigue cracks in flat plate specimens were found reliable. G.G.

N66-14750# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PROBLEM OF FLAME EMANATION IN LIQUID FUEL GAS TURBINE COMBUSTION CHAMBERS

V. I. Antonovskiy and Ya. P. Storozhuk 17 Sep. 1965 23 p refs Transl. into ENGLISH from Teploenerg. (Moscow), no. 3, 1965 p 41–47

(FTD-TT-65-858/1+2+4; AD-622363) CFSTI: HC $1.00/MF $0.50

A method for experimentally determining the properties of combustion and the effect of conditional parameters on the formation of soot in incomplete combustion are discussed. It was found that the content of soot in the volume of combustion flames increases with increase in pressure, decrease in air availability, decrease in stream turbulence, and with decrease in the air temperature at input. The distribution of soot in transverse sections of a monoregister chamber was found to be characterized by a profile with two maximums, their arrangement coincided with zones where greater concentration of incompletely combusted fuel occurs because of air shortage. E.E.B.

N66-14773*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

STATUS OF LARGE VACUUM FACILITY TESTS OF MPD ARC THRUSTOR

Robert E. Jones and Eddie L. Walker Washington, NASA, 1965 26 p refs Presented at the 3d AIAA Aerospace Sci. Meeting, New York, 24–26 Jan. 1966

(NASA-TM-X-52155) CFSTI: HC $2.00/MF $0.50 CSCL 21C

Performance tests of a magnetoplasmadynamic (MPD) arc thrustor are being conducted in a 15-foot-diameter, 65-foot-long vacuum tank. The thrust efficiency of the MPD arc thrustor with hydrogen or ammonia propellants was in excellent agreement with previously published data when the tank pressure was above 50 microns. A thrust efficiency with hydrogen of 6.5% was obtained at 1000 seconds specific impulse and increased to 16% at 2200 seconds. As the tank pressure was reduced to the attainable minimum, the thrust efficiency increased to 16.5% at 1000 second specific impulse and 25% at 2600 seconds. The thrust efficiency data with ammonia showed the same trends with reduced tank pressure as did hydrogen. At low tank pressure the thrust efficiency varied from 29% at 1250 seconds specific impulse to 70% at 5800 seconds. However, at the lowest tank pressure and propellant flow rate, the thrust efficiency exceeded the limit determined by energy efficiency at specific impulses greater than 3000 seconds. This obvious anomaly indicates that the proper testing environment for MPD arc thrustors is still undetermined. Autho

N66-14779*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A MERCURY ELECTRON-BOMBARDMENT ION THRUSTOR SUITABLE FOR SPACECRAFT STATION KEEPING AND ALTITUDE CONTROL

William R. Kerslake, Joseph F. Wasserbauer, and Paul M. Margosian Washington, NASA, 1965 39 p refs Presented at AIAA 5th Elec. Propulsion Meeting, San Diego, Calif., 7–9 Mar. 1966

(NASA-TM-X-52163) CFSTI: HC $2.00/MF $0.50 CSCL 21C

An ion thrustor system, including a new type of mercury feed system and a shielded neutralizer, has been designed and tested at a thrust level of 0.5 millipound. The use of a radial flow propellant distributor and an oxide-coated brush cathode resulted in discharge power losses one-fourth of those previously encountered at this thrust level. Different lengths and diameters of the discharge chamber were tested to establish a compromise between discharge power losses and propellant utilization. The final design discharge chamber was 5-centimeters in diameter and 7.5-centimeters long. The complete flight-type thrustor system used a permanent magnet field and weighed (without propellant) 1.36 kilograms. The power to thrust ratio, including power to heat the feed system and the neutralizer, was 222 watts per millipound at a thrust of 0.65 millipound and a specific impulse of 3050 seconds. The oxide-coated brush cathode was endurance tested 1553 hours in a thrustor and an identical cathode was heat cycled in a separate test for 418 000 cycles before failure. Author

N66-14816# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).

DIFFUSION FLAMES AND SUPERSONIC COMBUSTION Final Report, Apr. 1, 1963–Apr. 1, 1965

I. Da Riva [1965] 28 p refs

(Grant AF-EOAR-63-43)

(AFOSR-65-1604: AD-622581) CFSTI: HC $1.00/MF $0.50

This report presents a summary of work done on the behavior of reacting gases in supersonic combustion. The work undertaken comprises three areas: diffusion flames, combustion in the boundary layer, and combustion in a subsonic jet of fuel discharging in a supersonic coflowing stream of oxidizer. The structure of laminar diffusion flames has been analyzed in the limiting case of large, though finite, reaction rates. It is shown that the chemical reaction takes place only in a very thin region where convection effects may be neglected. The boundary layer flow past a hot wall is studied noting that the density at the outer edge of the boundary layer is much higher than the density close to the wall. Author (TAB)

N66-15028# Canadian Armament Research and Development Establishment, Valcartier (Quebec).

THE PROTECTION OF CARDE ROCKET NOZZLES BY FLAME SPRAYED CERAMIC COATINGS

F. Christie and J. Y. Belanger Aug. 1965 27 p refs Presented at the 15th CIC Chem. Eng. Conf. (Quebec), 25–27 Oct. 1965

(CARDE-TN-1684/65) CFSTI: HC $2.00/MF $0.50

CARDE nozzle designs are reviewed as an introduction to the performance requirements for rocket nozzles. Various ceramic-coating methods are briefly outlined, and a description of techniques for flame-spraying ceramics on nozzles follows. The note is completed by a short review of planned research into the problems of applying ceramics to various substrates likely to be of interest to nozzle designers as well as to engineers in Canadian Industry. Author

N66-15125# Joint Publications Research Service, Washington, D. C.

RESULTS OF THE MODERNIZATION OF THE VK-100-2 LMZ TURBINE

L. B. Zusmanovich 28 Dec. 1965 9 p Transl. into ENGLISH from Energ. i Elektrotekhn. Prom., Inform. Nauchn.-Tekhn. Sb. (Kiev), no. 3, 1965 p 50–52

(JPRS-33503; TT-65-34077) CFSTI: $1.00

Economy and efficiency were increased for the VK-100-2 LMZ turbine. Consumption and temperature of the cooling water remain practically unchanged when loading the turbine

from 100 to 115 Mw. Specific consumption of heat per turbine unit is not increased and the rated parameters of fresh steam are retained. Internal efficiency is plotted for both low and high pressure cylinders. M.W.R.

N66-15193# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Munich (West Germany).
INVESTIGATIONS ON THE COMBUSTION OF FUEL IN A JET PROPULSION UNIT BY MEANS OF EMISSION SPECTROSCOPY [UNTERSUCHUNGEN ZUR KRAFTSTOFFVERBRENNUNG IN DURCHSTROMTRIEBWERKEN MIT HILFE DER EMISSIONS SPEKTROSKOPIE]
G. Spengler, Julius Kern, and Hans Gemperlein Oct. 1965 29 p refs In GERMAN; ENGLISH summary
(DLR-FB-65-45) CFSTI: HC $2.00/MF $0.50

The intensity of emission in the C_2-, OH- and CH-bands has been determined spectroscopically along a cylindrical combustion chamber for four different temperatures of the entering air and two different diameters of the injection nozzle. The results permit conclusions on the decomposition and combustion of the fuel. They permit particular information on the relative combustion rate of the fuel, on the ignition rate, on gaseous or droplet combustion, and on pyrolytic prereactions of the fuel. Author

N66-15194# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
SOME EXPERIMENTAL PROBLEMS OF AIR INTAKES AND EXHAUSTS IN TURBINES [QUELQUES PROBLEMES D'EXPERIMENTATION DE PRISES D'AIR ET DE SORTIES DE REACTEURS]
Jacky Leynaert and Bernard Masure 1965 44 p refs In FRENÇH Presented at the A.F.I.T.A.E. Meeting on Applied Aerodynamics, Toulouse, 8–9 Nov. 1965
(TP-292) CFSTI: HC $2.00/MF $0.50

Problems concerning air intake and exhaust in turbine engines are discussed; and theoretical calculations for these problems are compared with wind tunnel test results. Air intake performance was determined in the case of a low Reynolds number and premature triggering of the boundary layer transition. Test measurements were made at speeds of Mach 2 and Mach 2.6. The effect of compressed air feeding on thrust was determined, and the velocity distribution upstream from the exhaust nozzle was calculated. Tests were conducted with a converging–diverging nozzle. Throughout, test results were in agreement with theoretical calculations. Transl. by D.T.

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N66-14334* National Academy of Sciences—National Research Council, Washington, D. C. Space Science Board
INTERACTION OF THE SOLAR WIND WITH THE PLANETS
Paul J. Coleman, Jr. (Calif. Univ., Los Angeles) *In its* Space Res. Dec. 1965 p 127–139 *refs* (See N66-14327 05-30)
CFSTI: HC $4.00/MF $0.75

A review is presented of observations of the properties of the interplanetary medium; and the development of theoretical models of the solar wind is summarized. Parameters typical of a quiet solar wind are calculated. Interaction of the solar wind with the Earth's dipolar magnetic field is described, and methods are given for scaling observed effects for interactions with dipolar fields of different moments. Speculations are offered about interaction of solar wind with planetary bodies not shielded by magnetic fields. M.W.R.

N66-14501# Emmanuel Coll., Boston, Mass. Oriental Science Library.
A STATISTICAL STUDY OF THE RELATION BETWEEN SOLAR FLARES AND MAGNETIC STORMS
Bai-qin Viang Bedford, Mass., AFCRL, Aug. 1965 22 p refs Transl. into ENGLISH from Ti Ch'iu Wu Li Hsueh Pao (Peking), v. 9, no. 1, 1960 p 38–46
(Contract AF 19(628)-5073)
(EMM-65-9; AD-623113) CFSTI: HC $1.00/MF $0.50

The relation between solar flares and magnetic storms is very close during years when solar activity is intense. Results of a statistical study show that magnetic storms possessing a sudden onset and a main phase most likely originate from solar flares. Solar flares have different storm producing effects. Those of class III more frequently originate storms which possess a sudden onset, a main phase, and a strong disturbance. Flares of class II in the belt within 45° of the central meridian of the solar disk have more notable effects in originating storms than those beyond 45°. This is not true of class III flares. This indicates that the magnitude of the conical angle of corpuscular emission from class III flares is usually greater than 45° while that from class II flares is less. In general flares within 45° more frequently originate storms than those beyond 45°, especially those within 30° which cause the most severe storms. This suggests that the conical angle of corpuscular emission is usually restircted to 30°. The flare-storm interval ranges from 45 to 55 hours. The class III flare-storm interval is ±4 hours shorter than the class II flare-storm interval. R.N.A.

N66-14509# Sacramento Peak Observatory, Sunspot, N. Mex.
THE BEHAVIOR OF SOME LINES OF RARE-EARTH ELEMENTS ON THE SOLAR DISK
N. N. Stefanovich [1963] 10 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (Moscow), v. 17, 1957 p 191–198 *Its* Solar Res. Note No. 33
(AFCRL-63-275; AD-621193) CFSTI: HC $1.00/MF $0.50

The behavior of equivalent widths and half-widths of some lines of rare earth elements on the solar disk was investigated: the center-limb effect, the transition from absorption to emission and the emission in active regions. The variation of the equivalent and half-widths for all the lines, from the center to the limb, was found to be alike and this was compared to that of other non-rare-earth elements. The comparison shows that the W-values of the non-rare-earths increase from the center to the limb, while W-values of rare-earth elements decrease. For four lines of rare earth in the wings of H and K of Ca II lines an appearance of emission is observed when approaching the solar limb (about $\rho = 0.90$). These four lines are strengthened in active regions and are observed in emission in some flares and flocculi at large distances from the limb($\rho \sim 0.65$). Author (TAB)

N66-14541# University Coll., London (England). Dept. of Physics.
PARTICLE HEATING EFFECTS IN THE UPPER F REGION
K. V. S. K. Nathan 1964 37 p refs
(Contract N62558-4155)
(AD-623598) CFSTI: HC $2.00/MF $0.50

Night time electron temperatures in the upper atmosphere obtained from the satellite Ariel I indicate an energy input to the ionosphere that is corpuscular in origin. Wilmore (1964) infers an energy flux of 40 ergs per sq-cm by electron volts. But estimates of energy flux based on observations on the intensity of the spectral bands of nitrogen, and neglecting all effects due to the magnetic field, suggest an energy flux two to three orders of magnitude smaller. A Fokker-Planck type diffusion equation is used to investigate the steady state flux densities built up in the upper atmosphere by a constant source of electrons subject to scattering and energy degradation processes. It is found that, when magnetic field effects are allowed for, it is possible to reconcile the energy flux inferred from the ionospheric heating effects with the much smaller flux suggested by optical emission. Author (TAB)

N66-14552*# State Univ. of Iowa, Iowa City. Dept. of Physics and Astronomy.

DETERMINATION OF HYDROGEN ION CONCENTRATION, ELECTRON DENSITY AND PROTON GYROFREQUENCY FROM THE DISPERSION OF PROTON WHISTLERS

Donald A. Gurnett and Stanley D. Shawhan Sep. 1965 44 p refs Sponsored in part by NASA *Its* Rept.-65-33 (Contract Nonr-1509(06))
(NASA-CR-69104; AD-471499) CFSTI: HC $2.00/MF $0.50 CSCL 20H

In this paper we discuss a method for determining H^+ concentration, electron density, and proton gyrofrequency in the vicinity of the satellite by measurements of the asymptotic frequency-time profile of a proton whistler near the proton gyrofrequency. This new technique is applied to proton whistlers received by the Injun 3 VLF receiver. The calculated values of H^+ concentration and electron density are shown to be in good agreement with measurements by other experimenters at similar altitudes, latitudes, and local times. It is shown that the wave energy of a proton whistler is guided very nearly along the geomagnetic field and that the parallel component of the group velocity is closely approximated by the group velocity for longitudinal propagation. It is found that for frequencies near the proton gyrofrequency at the satellite the kernel multiplying $n(H^+)^{1/2}$ in the travel time integral is large only in the region near the satellite. Assuming that the H^+ concentration is uniform within this region, an expression is derived for the travel time of a proton whistler near the proton gyrofrequency. Author

N66-14637*# California Univ., Berkeley. Space Sciences Lab.

THE GENERATION OF ELECTRON CYCLOTRON WAVES IN THE MAGNETOSPHERE AND THE TURBULENCE DIFFUSION OF OUTER BELT ELECTRONS

Richard I. Miller 20 Aug. 1965 136 p refs (Grant NsG-243)
(NASA-CR-69004) CFSTI: HC $4.00/MF $1.00 CSCL 04A

The velocity distribution of energetic electrons trapped on geomagnetic field lines in the magnetosphere is found to be unstable with respect to the generation of electron cyclotron (whistler mode) waves. The growth of these waves results from the excess of transverse over parallel energy inherent in any loss cone type of velocity distribution. As a result, a spectrum of electromagnetic electron cyclotron wave turbulence is set up in the magnetosphere. This turbulence field then reacts on the electrons to diffuse them in pitch angle, resulting in the scattering of electrons into the atmospheric loss cone and their precipitation from the outer radiation belt. A Fokker-Planck type of diffusion equation is set up to describe this scattering process and the pitch angle distributions it predicts are in agreement with satellite observations. The low level electron precipitation background is found to require a root mean square turbulence field of magnitude $4.0 \times 10^{-3}\ (6/L)^{3.5}$ gamma at the geomagnetic equator, while the frequent but short lived precipitation bursts require a momentary order of magnitude increase in this turbulence field strength. It is proposed that the pitch angle diffusion resulting from electron cyclotron turbulence is the dominant electron scattering mechanism in the outer radiation belt and determines trapped electron precipitation rates and lifetimes. Author

N66-14664# Royal Aircraft Establishment, Farnborough (England).

PREDICTION OF THE DATES AND INTENSITIES OF THE NEXT TWO SUNSPOT MAXIMA

D. G. King-Hele Nov. 1965 15 p refs
(RAE-TR-65244) CFSTI: HC $1.00/MF $0.50

A 7-cycle recurrence tendency is used to predict the dates of the maxima of the present and the subsequent sunspot cycles, namely 1968.1 and 1978.5. The maximum smoothed monthly sunspot number R_m appears to depend primarily upon the time of rise t_R from sunspot minimum to maximum, and an empirical relationship between t_R and R_m is utilized for predicting values of R_m at the next two maxima, namely 140 and 110. The predictions are needed for various practical purposes, but the validity of the method is disputable, and there can be no certainty that the predicted dates or intensities are even approximately correct. Author

N66-14832* National Aeronautics and Space Administration, Washington, D. C.

REPORT OF PARTICLES AND FIELDS WORKING GROUP

In its NASA 1965 Summer Conf. on Lunar Exploration and Sci. 1965 p 289–353 (See N66-14826 05-29) GPO: HC $1.50; CFSTI: MF $2.25

Lunar magnetic and electric fields, particle measurements on or near the moon, and solar energetic particles are among the subjects discussed. Individual reports are included for each of these as well as for galactic cosmic rays, neutrons, charged albedo, radio astronomy and radio propagation, and lunar atmosphere and ionosphere. It is recommended that early lunar probes include a magnetometer and a particle detector to measure gross lunar electrical conductivity, and thermalized solar wind in the lunar atmosphere, and the interaction of this wind and lunar surface. Early measurement of lunar atmosphere and ionosphere is also recommended. Similar measurements should be made on lunar orbiter missions, with experiments made in two different orbits. M.W.R.

N66-14888 Library of Congress, Washington, D. C. Aerospace Technology Div.

THE PRIMARY COSMIC RAYS OF THE SUN AND THEIR DECOMPOSITION INTO SECONDARY COMPONENTS IN THE TERRESTRIAL ATMOSPHERE

Edward Gelins *In its* Foreign Sci. Bull., Vol. 1, No. 12 Dec. 1965 p 1–7 refs (See N66-14887 05-34)

Three Soviet papers are reviewed which attempt to study processes related to the decomposition of galactic cosmic rays in the terrestrial atmosphere. The papers contribute to the improvement of knowledge of the processes of decomposition, which are at present only partially understood. The aim of Soviet investigations of secondary cosmic rays is to obtain new data on the nature of primary particles and their transformation into secondary particles. Author

N66-14961*# RCA Victor Co., Ltd., Montreal (Quebec). Research Labs.
TIME HISTORY OF THE MAGNETOSPHERIC CAVITY
F. J. F. Osborne, M. P. Bachynski, and J. V. Gore Jun. 1965 32 p refs Presented at URS; Spring Meeting, Washington, D. C., 1965
(Contract NASw-1088)
(NASA-CR-69201; RCA Res. Rept.-7-801-38) CFSTI: HC $2.00/MF $0.50 CSCL 20H

Scale model laboratory experiments simulating the effect of the solar wind on the magnetosphere have shown the time history of the formation and breakup of the magnetospheric cavity. Time resolved (1 μsec) data on the visible "standoff" interaction show that the quasi Van Allen belts first become visible well within the cavity at the time the plasma wind encounters the fringing terrella field. The belts at this time show a definite structure with "ribbons" of plasma along the field lines. This structure is probably associated with oscillatory phenomena present in the belts and their excitation mechanism. The polar views show considerable asymmetry of both the internal and external phenomena throughout the interaction. The visual asymmetries indicate that the plasma in the tail of the dipole magnetic field "wags" as the interaction builds up and decays. Magnetic field measurements in the equatorial plane show a similar motion of the magnetic field in the tail. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N66-14327*# National Academy of Sciences—National Research Council, Washington, D. C. Space Science Board.
SPACE RESEARCH: DIRECTIONS FOR THE FUTURE. PART ONE: PLANETARY AND LUNAR EXPLORATION
Dec. 1965 144 p refs Rept. of Summer Study held at Woods Hole, Mass., Jun.–Jul. 1965
(Contract NSR-09-012-903)
(NASA-CR-69076) CFSTI: HC $4.00/MF $0.75 CSCL 22A

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WORKING PAPERS: TOPICAL REVIEWS

9. ORIGIN AND EVOLUTION OF THE SOLAR SYSTEM George B. Field p 61–63 refs
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15. PLANETARY MAGNETIC FIELDS R. Hide p 81–90 refs (See N66-14329 05-30)
16. GEOLOGY OF PLANETARY SURFACES D. U. Wise and J. W. Salisbury p 90–96 (See N66-14330 05-30)
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20. THE EARTH VIEWED FROM SPACE Leo Steg p 121–124
21. GEOLOGY OF THE EARTH'S SURFACE AS VIEWED FROM SPACE D. U. Wise p 125–127
22. INTERACTION OF THE SOLAR WIND WITH THE PLANETS P. J. Coleman, Jr. p 127–139 refs (See N66-14334 05-29)

N66-14328* National Academy of Sciences—National Research Council, Washington, D. C. Space Science Board.
CHEMISTRY OF THE SOLAR SYSTEM
P. W. Gast (Lamont Geol. Obs.), L. H. Aller (Calif. Univ., Los Angeles), and Gunnar Kullerud (Carnegie Inst. of Washington) *In its* Space Resg Dec. 1965 p 66–73 (See N66-14327 05-30) CFSTI: HC $4.00/MF $0.75

The sun, meteorites, Jovian planets, and other planets and the Earth are discussed in a paper dealing with the chemical composition of the solar system. It is pointed out that solar abundance data are limited to those elements which can be identified and measured; and it is recommended that better laboratory data on atomic and molecular spectra and theoretical calculations of transition probabilities and damping constants of spectral lines are urgently needed. Also needed are detailed observations of shapes and intensities of many spectral lines, additional knowledge about solar photosphere and isotopic abundances; and data on chemical composition of solar wind and solar cosmic rays. Since meteorites can provide information on the chemistry of the solar system, synthetic studies on textures and compositions found in meteorites are recommended. With regard to the Jovian planets, intensive spectroscopic and balloon observations are among the recommended procedures. M.W.R.

N66-14329 National Academy of Sciences—National Research Council, Washington, D. C. Space Science Board.
PLANETARY MAGNETIC FIELDS
Raymond Hide (MIT) *In its* Space Res. Dec. 1965 p 81–90 refs (See N66-14327 05-30) CFSTI: HC $4.00/MF $0.75

Magnetic fields of the Earth, Venus, Mars, Jupiter, and Saturn are discussed. It is pointed out that the evidence for significant magnetic fields of internal origin in strong for only the Sun, Earth, and Jupiter; and a Mariner IV space probe magnetometer has measured the magnetic field strength near Mars. Present knowledge of the Earth's main magnetic field, modern theories of the origin of the Earth's field, and the hydromagnetics of the Earth's core are considered. Circumstantial evidence is presented for the fields of the other planets. M.W.R.

N66-14330* National Academy of Sciences—National Research Council, Washington, D. C. Space Science Board.
GEOLOGY OF PLANETARY SURFACES
D. U. Wise (Franklin and Marshall Coll.) and J. W. Salisbury (AFCRL) *In its* Space Res. Dec. 1965 p 90–96, (See N66-14327 05-30) CFSTI: HC $4.00/MF $0.75

Geographic and spatial control, sample and site examination, process studies, and sequence and dates of geological events are among the problems discussed in relation to planetary surfaces. Among the nonuniformitarian, or those which exhibit abrupt departures from present conditions, events considered are fossil oceans, planetary tectonic patterns changing with time, ancient glacial periods, catastrophism, fossils, and past atmospheres. It is recommended that a broad base be maintained for scientific planetary probes; and that a great deal of planetary data be obtained from the Earth by balloons or satellite-borne telescopes. Telemetry and methods to return data to the Earth must be improved. M.W.R.

N66-14331* National Academy of Sciences—National Research Council, Washington, D. C. Space Science Board.
UPPER ATMOSPHERES OF THE PLANETS
Joseph W. Chamberlain (Kitt Peak Natl. Obs.), and Richard M. Goody (Harvard Univ.) *In its* Space Res. Dec. 1965 p 96–107 refs (See N66-14327 05-30) CFSTI: HC $4.00/MF $0.75

A priority system is set up for experiments dealing with planetary upper atmospheres, and a bibliography is included for articles on the subject. Studies serving engineering requirements for support of exploration are considered urgent; programs related to exobiology and the evolution of life are rated important; and research bearing on the origin and evolution of the solar system is classified as desirable. The general area of illuminating the comparative anatomy of atmospheres is considered as academic. A recommended program for obtaining data considers topside sounders, airglow measurements, densities from drag data, magnetic fields, special scans of resonance lines, Raman spectra, ultraviolet photometry and absorption from sunlight, far infrared emissions, and occultations. The bibliography lists articles according to (1) general reviews, (2) atmospheric evaporation and evolution, and planetary coronas, (3) composition and photochemistry, (4) structure of upper atmospheres and ionospheres, and (5) airglow and other optical measurements. Some of the references are annotated. M.W.R.

N66-14332* National Academy of Sciences—National Research Council, Washington, D. C. Space Science Board.
ON THE CIRCULATION OF THE ATMOSPHERES OF JUPITER AND SATURN
Raymond Hide (MIT) *In its* Space Res. Dec. 1965 p 107–114 refs (See N66-14327 05-30) CFSTI: HC $4.00/MF $0.75

By concentration on interpretation in terms of hydrodynamical theory of prominent visual features, certain key processes related to the atmospheres of Jupiter and Saturn can be viewed with a minimum of speculation. For Jupiter, it is pointed out, there is the possibility that observations of visual markings in combination with radio astronomical data can lead to information on the internal structure of the planet. Observations made on Jupiter and Saturn are given and theoretical consideration is given to the atmospheric content of these planets. Parameters required to characterize the dynamics of the planetary atmospheres are discussed. The existence of rapid equatorial currents in the fluid layers of both Saturn and Jupiter is mentioned; and apparent variations in equatorial zone of Jupiter from 1908 through 1947 are graphed. Also shown are the longitudinal wanderings of the Great Red Spot between 1831 and 1960; and it is suggested that these variations may be manifestations of a gross torsional hydromagnetic oscillation. M.W.R.

N66-14333* National Academy of Sciences—National Research Council, Washington, D. C. Space Science Board.
COMETS AND INTERPLANETARY DUST
J. A. Wood (Chicago Univ.) *In its* Space Res. Dec. 1965 p 115–121 (See N66-14327 05-30) CFSTI: HC $4.00/MF $0.75

The nature and composition of comets is discussed along with importance of cometary studies from the Earth, fly-by missions for comet probes, and landing on a comet nucleus. Experiments with sounding rockets and earth satellites are mentioned. Interplanetary dust, which is believed to be cometary debris for the most part, is considered. Brightness and polarization measurements from planetary probes, coupled with particle impact count rates, could shed light about the zodiacal dust cloud. M.W.R.

N66-14370# Northrop Corp., Newbury Park, Calif. Ventura Div.
DESIGN STUDY FOR THE OPTIMIZATION OF VOYAGER LANDING SYSTEMS
John H. Moeller 30 Sep. 1963 160 p refs
(NVR-2807)

A study has been conducted to determine feasible landing systems for the Voyager Mars and Venus lander vehicles and to establish the means for selecting optimum landing systems for each vehicle. Important parameters governing the design of each landing system assessed include vehicle mission, limits of uncertainty of the planetary atmosphere and planetary surface conditions, limits of deployment of aerodynamic decelerators, vehicle impact velocity, and materials considerations relative to their availability and ability to withstand the anticipated environments. The results of the study indicate the optimum landing system for the Mars lander vehicle consists of a textile drogue parachute/main parachute descent systems and a crushable-stainless-steel-honeycomb or frangible-aluminum-tube-decelerator-type touchdown system, designed for an impact velocity of 60 fps or higher. The optimum landing system for the Venus lander vehicle consists of a high-temperature-resistant, self-inflating, conical Ballute descent system, pilot chute deployed, and a crushable-stainless-steel-honeycomb-decelerator-type touchdown system, designed for an impact velocity of 60 fps or higher. Author

N66-14387*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE HIGH ORDER EFFECTS IN THE METHODS OF KRYLOV-BOGOLIUBOV AND POINCARE
Peter Musen Washington, NASA, Jan. 1966 19 p refs (NASA-TN-D-3128) CFSTI: HC $1.00/MF $0.50 CSCL 03C

In this article the formal process for determining the highest order perturbations of the orbital elements is developed by using the methods of Krylov-Bogoliubov and Poincaré. Such a development is necessary, for example, in the lunar problem where very high order perturbations have to be determined. The differential equations are formed for the elements which are affected only by the long period and the secular terms. The problem of determining these elements, as well as eliminating the short period effects, is reduced to solving a set of partial differential equations, step by step. By developing the displacement operator into a series of the differential operators of Faa de Bruno we can write these equations in a concise form. Author

N66-14388*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PLANETARY PERTURBATIONS IN CHEBYSHEV SERIES

Lloyd Carpenter Washington, NASA, Jan. 1966 92 p refs
(NASA-TN-D-3168) CFSTI: HC $3.00/MF $0.75 CSCL 03C

The practical value of using Chebyshev series in solving the equations of planetary motion is demonstrated. Solutions are obtained for the mutual attractions of the five outer planets. Residuals from comparisons with numerical integrations are less than 0.001 in all cases for the two-century interval from 1800 through 2000. A listing is given of the FORTRAN IV program used for the computations. The first order general perturbations of the outer planets due to the inner planets are given for completeness. Author

N66-14404# Space Technology Labs., Inc., Redondo Beach, Calif.
SOME TRAJECTORY CONSIDERATIONS FOR THE APOLLO MISSION
J. A. Herbaugh, L. L. Lakamp and P. A. Penzo 10 Oct. 1964 53 p refs
(STL-9883-5-22)

The analysis reported herein will be concerned with two of the more important aspects of the mission parameter study. The first is to establish a procedure for a general parametric study which will yield a maximum amount of data. The second is to analyze several modes of operation in the lunar phase which will satisfy certain mission constraints while optimizing service module performance. Consideration will be given to the unrestricted and the free circumlunar translunar trajectory. In both cases the consequences of imposing a pericynthion deboost and/or the LEM ascent plane change constraints will be derived. Author

N66-14418*# Texas A&M Research Foundation, College Station. Industrial Engineering Dept.
THE DETERMINATION OF EMPIRICAL AND ANALYTICAL SPACECRAFT PARAMETRIC CURVES: THEORY AND METHODS Progress Report No. I
1 Dec. 1965 71 p refs
(Grant NGR-44-001-027)
(NASA-CR-68967) CFSTI: HC $3.00/MF $0.75 CSCL 22A

Data are presented and discussed concerning: a philosophy of cost model development; estimation of parameters with constraints for models which are nonlinear in the parameters; utilization of subjectively determined data in the formulation of mathematical models; informal consulting memoranda; and the learning curve. R.W.H.

N66-14444# RAND Corp., Santa Monica, Calif.
OLBERS' PARADOX AND COSMOLOGICAL MODELS
A. G. Wilson Oct. 1965 21 p refs
(P-3256; AD-623282) CFSTI: HC $1.00/MF $0.50

A review of Olbers' Paradox is given; it is noted how Olbers' assumptions, postulated in 1826, can be used to classify generically the current cosmological models. Hierarchal homogeneity was examined as a basis for new types of cosmological models. The assumption of hierarchal distribution of matter is suggested to account for the observed night-sky brightness. TAB

N66-14457# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
NOTE ON THE SHAPE AND INTERNAL STRUCTURE OF THE MOON
C. L. Goudas Jul. 1965 8 p refs *Its* Mathematical Note No. 418
(DI-82-0454; AD-623292) CFSTI: HC $1.00/MF $0.50

On the basis of the best measurements available to date, the assumption that the elevation of the lunar maria is systematically smaller than the elevation of the continents is shown herein to be unjustified. As a result, the figure of the Moon cannot be studied from the distribution of maria on its surface, as Lamar and McGann have suggested in their paper (in press, ICARUS, 4) discussed here. Author (TAB)

N66-14483# Royal Aircraft Establishment, Farnborough (England).
ORBITAL PARAMETERS OF STAR-RAD (1962 β κ FOR 1962 TO 1964
R. J. Tayler Oct. 1965 23 p refs
(RAE-TR-65223) CFSTI: HC $1.00/MF $0.50

Nine hundred fifty-seven optical observations of the satellite STAR-RAD were used to determine its orbit at irregular intervals in the years 1962 to 1964. A table of orbital parameters is given for 60 nodes spread over 26 months. Less than 10% of the observations were rejected during the analysis and the accuracy of the accepted observations was found to conform to the a priori estimates. Author

N66-14524# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.
CONTROL AND HEAT SHIELD REQUIREMENTS FOR BANK-MODULATED SUPERCIRCULAR ENTRY
Lawrence T. Brekka (M.S. Thesis) Feb. 1965 210 p refs
(Contract AF 04(694)-553)
(T-403; AD-623628) CFSTI: HC $5.00/MF $1.25

Bank modulation for supercircular entry was investigated from a control and heating standpoint. The use of error rates in feedback for pitch and yaw loops rather than inertial rates was shown to produce reaction-jet impulse savings on the order of 80 percent. Heating was investigated for (1) a pointed half cone trimmed at (L/D) max, (2) a blunted half sphere-cone trimmed at (L/D) max, (3) a blunted half sphere-cone trimmed at (C)L max—all these with the round side windward—and (4) a delta-winged glider trimmed to give the L/D of configuration (1). These vehicles were considered to have a 12-man payload capacity. The blunted half sphere-cone trimmed at (C)L max required the least heat protection weight. Author (TAB)

N66-14527*# Philco Corp., Palo Alto, Calif. WDL Div.
INTERPLANETARY NAVIGATION AND GUIDANCE STUDY. VOLUME II: TECHNICAL STUDY
30 Oct. 1965 176 p refs
(Contract NAS8-11198)
(NASA-CR-69103; WDL-TR2629) CFSTI: HC $5.00/MF $1.00 CSCL 22C

A detailed analysis of navigation and guidance requirements during the midcourse and orbital phases of a 1975 roundtrip Mars mission is presented. Four navigation system configurations, varying in complexity from one that depends entirely on earth-based tracking and computations to one with a total onboard navigation capability, are evaluated; it is assumed that the observation data are processed with a minimum variance Kalman filter to estimate the vehicle state. Theoretical concepts and statistical concepts of state estimation are introduced, and a linear analysis about a nominal trajectory is applied to all phases of the study. Methods of propagating statistical errors, and of deriving guidance execution errors are discussed. Digital computer simulation is described, and onboard measurement techniques are analyzed. Details are given on the Earth–Mars midcourse and Mars–Earth midcourse studies, and the Mars orbital analysis; the capabilities and

accuracies for each system are discussed. Data are also included on the derivation of the covariance matrix and orbital element gradients; the measurement gradient; and interplanetary trajectories. M.G.J.

N66-14539# TRW Systems, Redondo Beach, Calif. Research Section.

THE METEOROID ENVIRONMENT: A SELECTED BIBLIOGRAPHY

L. R. Magnolia 3 Nov. 1965 16 p refs *Its* Spec. Lit. Survey No. 11

(STL-9990-7156-KU-000)

This selected bibliography on the meteoroid environment covers all phases of aerospace research and development that have to consider meteoride impacts, interplanetary dust, and debris and radiation effects in the earth's vicinity and in outer space travel. G.G.

N66-14550# Boeing Scientific Labs., Seattle, Wash. Mathematics Research Lab.

THE NATURE OF SECONDARY CRATERS PHOTOGRAPHED BY RANGER VII Mathematics Note No. 430

Zdenek Kopal Sep. 1965 42 p refs

(DI-82-0475; AD-623299) CFSTI: HC $2.00/MF $0.50

A mathematical theory of the ejection of secondary fragments from the focus of primary impacts on the Moon has been developed for the case of a spherical bounding surface. An application of the results to the frequency-distribution of the secondary lunar craters in the region of Mare Cognitum, as determined from photographs secured by Ranger VII in July 1964, leads to a conclusion that the sum total of the mass required to produce all observed craters or crater-like formation in Mare Cognitum overlying Tycho's rays by secondary impacts of particles ejected from Tycho would—if spread evenly over the surface—cover the ground by a layer of debris about half a metre in thickness at the distance of 1000 km from the focus of ejection; and the volume of the material thus splashed out all over the Moon would exceed the volume excavated by the primary impact at least ten to twenty times. On the strength of this evidence a hypothesis is advanced that a large fraction of depressions, smaller than 1 km in size, counted as craters due to secondary impacts, are in reality subsidence formations, possibly triggered by 'moonquakes' which must occur in the wake of all major primary impacts on the Moon. Author (TAB)

N66-14551*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

ANALYTICAL DEVELOPMENT OF THE PLANETARY DISTURBING FUNCTION ON A DIGITAL COMPUTER

I. G. Izsak, B. Benima, and Sara B. Mills [1964] 65 p refs (Grant NsG-87-60)

(NASA-CR-69093; SAO Special Rept.-164) CFSTI: HC $3.00/MF $0.75 CSCL 03B

An IBM 7094 computer program for the analytical development of the planetary disturbing function is described. As the planetary disturbing function takes slightly different forms depending on the chosen coordinates in the basic differential equations of motion, the conventional relative coordinates and the canonical relative coordinates are used to define the oribital elements. Equations are given for developing the complimentary and principal parts of the disturbing functions, and the assumption is then made that these parts have been merged. The pattern of indices is described. The program is written in Fortran II, and double precision arithmetic is used. Limitations, method, and usage are discussed. Two printout samples of the program, pertaining to the planets Jupiter and Saturn are included. M.G.J.

N66-14575# RAND Corp., Santa Monica, Calif.

PHYSICAL VIEWS ON THE ORIGIN OF THE UNIVERSE

Albert Wilson Oct. 1965 19 p Presented at Loyola Univ. Golden Jubilee Lectures in Sci., 6 Dec. 1964

(P-3247; AD-623109) CFSTI: HC $1.00/MF $0.50

The essential difference between the cosmological thinking of the ancients and scientific cosmological thinking is examined, and the point is made that man must be included in all cosmologies as an observer who images the universe according to his own limitations. Principles used in building cosmological models, and their past applications, are reviewed, with consideration given to the principle of uniformity, the cosmological principle, and the perfect cosmological principle. Epistemological difficulties concerning the concept of the universe itself are also discussed. The development of present day cosmologies is traced, and it is pointed out that independent observational discovery and theoretical prediction of an expanding universe brought the general theory of relativity, and models based on it, to a dominant position in cosmological thinking. Relativistic and steady-state models are described, along with the modifications made as new observational data were obtained. Recent astronomical discoveries are recounted, and their impact on existing theories noted. Several questions are posed, and it is suggested that future cosmological research may focus on seeking their solution. M.G.J.

N66-14604# National Academy of Sciences—National Research Council, Washington, D. C.

GROUND-BASED ASTRONOMY: A TEN YEAR PROGRAM

1964 131 p

Presented is an assessment of the direction that the observational branch of ground-based astronomy is likely to take in the decade ahead. The present position in theoretical astrophysics, optical astronomy, radio astronomy, graduate education, and manpower is reviewed and a program for the future is recommended. The report includes a look at the magnitude of the effort required and surveys the cost of program implementation. E.E.B.

N66-14814# Grumman Aircraft Engineering Corp., Bethpage, N. Y.

COMMINUTION IN VACUO

J. D. Halajian Sep. 1965 20 p refs

(RM-296; AD-471193)

Preliminary remarks concerning experimental investigations that involve, essentially, a more realistic simulation of 'lunar soils' (in terms of 'clean surface' interactions) than hitherto attempted are made. The important difference that could exist between previously contaminated soils outgassed in vacuo and those originally produced in vacuo is stressed. It is found that comminution in vacuo will lead to more meaningful laboratory investigations of 'clean soils' likely to exist on the moon and greater understanding of problems in soil-to-soil or vehicle-to-soil interactions that could be encountered on the moon. Author

N66-14636*# Florida State Univ., Tallahassee. Radio Astronomy Observatory.

A CATALOG OF RADIO OBSERVATIONS OF JUPITER 1961–1964

D. Morrow, C. H. Barrow, and G. M. Resch [1965] 58 p refs (Grant NsG-224)

(NASA-CR-69110) CFSTI: HC $3.00/MF $0.50 CSCL 03A

During the observing season daily log sheets are kept in which are noted the date the watch ends, the beginning and ending times in Universal Time of observation and any

activity, the identification number, the System II Central Meridian Longitude, the Julian date, the average of the three largest Jupiter noise deflections, and the average galactic background level. Later this information is transferred directly to IBM punch cards. For this catalog a program was devised which prints out the year, frequency, and station at which the observations were made. Beneath are the month, day, begin and end time in Universal Time of observation and activity, the identification number, and the beginning and ending time of activity in System III (1957) Central Meridian Longitude. A complete list of 18 Mc/s observations at Tallahassee is provided for each year. In addition there is a combined list of outstation observations during 1964 in which is included only activity reported simultaneously or nearly simultaneously at two or more stations. This restriction is imposed as an additional identification criterion. Author

N66-14639*# Kansas State Univ., Manhattan. Dept. of Physics.

[SPACE ENVIRONMENT ANALYSES, HUMAN PERFORMANCE STUDIES, AND GRAVITATIONAL FIELD EFFECTS ON ENZYMATIC REACTIONS]

E. Brock Dale et al [1965] 45 p refs

(Grant NsG-692)

(NASA-CR-69104) CFSTI: HC $2.00/MF $0.50 CSCL 03A

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1. THE MEASUREMENT OF LUNAR RADIATION E. B. Dale 8 p refs

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3. ANALYTIC STUDIES IN THE LEARNING AND MEMORY OF SKILLED PERFORMANCE M. E. Noble and W. F. Daves 2 p

4. OPTIMIZATION OF SPACE SYSTEM DESIGN G. F. Schrader 2 p

5. EXPERIMENTS WITH ULTRAVIOLET LIGHT C. E. Mandeville 8 p

6. WIDTH OF THE TRACKS OF HEAVY IRONS IN EMULSIONS AND OTHER MEDIA R. Katz 1 p

7. STATISTICAL RADAR ECHO ANALYSIS AND ITS APPLICATION TO PLANETARY RETURN K. Krishen and W. W. Koepsel 15 p refs

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N66-14644# Air Force Cambridge Research Labs., Bedford, Mass. Lunar-Planetary Research Branch.

STRUCTURES INSIDE A LUNAR CRATER PHOTOGRAPHED BY RANGER VII

Vern G. Smalley and Luciano B. Ronca Nov. 1965 19 p refs

Frame number 199 of Ranger VII's camera A reveals three structures in a 235 meter diameter crater. The three features were analyzed in three different ways, using three-dimensional clay models, tonal contour maps, and over-exposed-underdeveloped prints. The conclusion that the structures are the result of an impact appeared unlikely due to the presence of steep walled structures and topographic lows. The endogenous theory is favored and it is suggested that mechanisms such as rootless volcanic activity, real volcanic activity, or venting volatiles are responsible for this feature. E.E.B.

N66-14652# Royal Aircraft Establishment, Farnborough (England).

EVEN TESSERAL HARMONICS IN THE GEOPOTENTIAL DERIVED FROM SYNCOM 2

R. R. Allan and B. A. M. Piggott Aug. 1965 12 p refs

(RAE-TM-SPACE-72; RAE-TM-MATH-67; AD-469839)

The longitudinal forces due to the very slight asymmetry of the Earth about its axis can have considerable effects on nearly synchronous satellites. Here the motion in longitude of Syncom 2 during five separate periods of free drift has been used to evaluate the constants of the first few even tesseral harmonics in the geopotential. Author (TAB)

N66-14655# Control Data Corp., Minneapolis, Minn.

INFORMATION CONTENT OF PHOTOGRAPHIC STAR IMAGES

Edward J. Farrell [1965] 35 p refs Presented at the 1965 Ann. Meeting of the Optical Soc. of Am., Philadelphia, 5–8 Oct. 1965

This paper is primary concerned with the position measurements of weak stars. The position accuracy is determined by the star brightness, brightness of airglow and zodiacal light, magnitude of seeing, and image shape. In fact, these factors impose an intrinsic limit on the position accuracy. Explicit equations for the minimum rms position error that one can achieve are presented. This accuracy limit is compared to experimental observations on plates taken with the 48 inch Palomar-Schmidt telescope. Author

N66-14661# Joint Publications Research Service, Washington, D. C.

TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO. 264 (PIERCING THROUGH THE CLOUDS FOR (SPACE) SECRETS)

Chao Hsin 21 Dec. 1965 12 p Transl. into ENGLISH from Hang-k'ung Chih-shih (Peiping), v. II, no. 8, 7 Aug. 1965 p 1–3

(JPRS-33419; TT-65-33993) CFSTI: $1.00

An elementary discussion is presented of geophysical rockets, rocket technology, and space craft technology. Definitions are given, and comparisons are made between atmospheric and geophysical rockets. Examples and experiments are mentioned, and areas of application cited. C.T.C.

N66-14668# Royal Aircraft Establishment, Farnborough (England).

DRAG COEFFICIENTS OF SPHERICAL SATELLITES

G. E. Cook Oct. 1965 36 p refs

(RAE-TR-65218) CFSTI: HC $2.00/MF $0.50

The drag of spherical satellites at heights of 150–800 km is reviewed in the light of recent studies of gas-surface interactions and atmospheric composition. The drag coefficient is approximately constant at low altitudes. At heights above 400 km (low solar activity) or 600 km (high solar activity) the drag coefficient increases with height, since both the amount of energy transfer and the molecular speed ratio decrease as the molecular weight of the atmosphere decreases. Electric drag is unimportant for the majority of satellites used in studies of air density. Author

N66-14673# Royal Aircraft Establishment, Farnborough (England).

FLUCTUATIONS IN THE DENSITY OF THE ATMOSPHERE IN 1960–1963 OBTAINED FROM THE ORBITAL VARIATIONS OF ARTIFICIAL EARTH SATELLITES [KOLEBANIYA ATMOSFERNOI PLOTNOSTI V 1960–1963 POLUCHENNYE PO IZMENENIYAM ORBIT ISKUSSTVENNYKH SPUTNIKOV ZEMLI]

N. P. Slovokhotova Sep. 1965 13 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 3, no. 3, 1965 p 469–472

(RAE-LIB-TRANS-1128) CFSTI: HC $1.00/MF $0.50

The diurnal fluctuations in atmospheric density at heights of 200 to 300 km were investigated by analyzing the observations of Soviet artificial earth satellites. The investigations have confirmed the presence of diurnal fluctuations in density at these heights at a period near the minimum of solar activity (1962–1963). As a result of the diurnal effect the density at a height of 300 km varies approximately by a factor of 2, and at a height of 200 km by 10–20%. At a height of approximately 300 km a small fall in density (of the order of 20% was noted (both by day and by night) between 1960 and 1962. Author

N66-14680# Radio and Space Research Station, Slough (England).

OPTICAL OBSERVATIONS RECEIVED BY THE PREDICTION SERVICE FOR THE MONTH OF JULY 1965

[1965] 21 p CFSTI: HC $1.00/MF $0.50

Coordinates of observing stations and explanatory notes are tabulated for satellite observations made during July 1965. Data for 18 U.S. and U.S.S.R. satellites are included. M.W.R.

N66-14703*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MANNED MARS LANDING MISSION BY MEANS OF HIGH-THRUST ROCKETS

Roger W. Luidens, Richard R. Burley, Joseph D. Eisenberg, Jay M. Kappraff, Brent A. Miller et al Washington, NASA, Jan. 1966 113 p refs

(NASA-TN-D-3181) CFSTI: HC $4.00/MF $0.75 CSCL 22A

An analysis of alternate mission profiles for a manned Mars landing mission in 1980 is presented. Considered were corpuscular radiation shielding, atmospheric entry, structures, solar-flare protection, chemical and nuclear engines, trajectories, and life-support systems. Interactions between the various subsystems were examined to assess the associated weight penalties and to develop those systems that can serve multiple purposes. High-thrust nuclear and chemical propulsion systems were projected for manned landing missions of one to three years in duration, a table contains comparable data of inputs for the presented analysis and those of other analyses. G.G.

N66-14704*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PAYLOAD OPTIMIZATION OF MULTISTAGE LAUNCH VEHICLES

Fred Teren and Omar F. Spurlock Washington, NASA, Jan. 1966 54 p refs

(NASA-TN-D-3191) CFSTI: HC $2.00/MF $0.50 CSCL 22A

The methods of the calculus of variations are used to maximize payload capability for multistage launch vehicles. The method of solution uses the Lagrange multipliers to determine the optimum thrust direction profile, as well as to construct partial derivatives of payload with respect to the stage propellant loadings and a booster steering parameter. These derivatives are used to terminate the stages and/or as terminal equations to be satisfied. Maximum payload can thus be achieved with a single solution, rather than with a family of parametric results. Constant thrust and specific-impulse operation is assumed for each upper stage (booster thrust and specific impulse vary with atmospheric pressure), and structure weight can be either fixed or a linear function of the stage propellant loading. Two-dimensional flight in a central, inverse-square gravitational field is assumed. Numerical results are presented for two- and three-stage launch vehicles flown to circular orbit and earth escape, respectively. Parametric results are presented and compared with the overall optimum solution obtained by use of the variational technique. Author

N66-14751*# General American Transportation Corp., Niles, Ill. MRD Div.

LUNAR SURVEY PROBE SENSOR STUDY Summary Report

17 Jun. 1965 20 p

(Contract NAS9-3731)

(NASA-CR-65191; MR-1272-2) CFSTI: HC $1.00/MF $0.50 CSCL 22A

Penetration into the lunar soil is found to be the most useful and reliable parameter for assessing a lunar surface site's acceptability of a lunar Excursion Module's (LEM) safe landing. For a wide range of soil models (using sand, fly ash, and styrofoam), the best penetrometer configuration is one which retains the mass per unit area and the maximum impact velocity of the LEM, and thereby automatically provides simulation of kinetic energy and momentum per unit area. The recommended penetrometer has a base diameter of 0.75 inches, which corresponds to a weight of 1.3 pounds for the normal LEM areal density of 0.093 slugs per square inch. Penetration should be measured by an impact at 10 feet/second, and the GO/NO-GO landing criterion be based on a penetration threshold of 10 inches. It is recommended that the communications system be in a radio frequency region, and that the transmitter be operated cyclically in a 10% duty cycle to provide an operating life of approximately 10 hours. The delivery system should be based on the use of a torus (inflated bag) to provide stable orientation upon coming to rest. M.W.R.

N66-14752*# Eastman Kodak Co., Rochester, N. Y. Apparatus and Optical Div.

LUNAR PHOTO STUDY Final Report, 1 Dec. 1964–1 Oct. 1965

George T. Keene 1 Oct. 1965 159 p

(Contract NAS9-3826)

(NASA-CR-65190; Z-3841) CFSTI: HC $5.00/MF $1.00 CSCL 03A

The effect of several photographic parameters on the detection and identification of lunar surface details was investigated by evaluation of photographs of models dusted with copper oxide to match the lunar photometric function. Two kinds of models were dusted and photographed: the first contained both concave and convex cones and hemispheres; the second was a realistic lunar landscape based on measurements from pictures taken by Rangers 7 and 9. In general, stereo and oblique photography revealed only slightly smaller objects than were identifiable in a single picture taken perpendicular to the model. It is shown that maximum information is obtained from pictures exposed at phase angles (angles between sun and observers) between 70° and 85°. With such angles, it is possible to detect objects equal in size to the limiting system and to identify objects twice this size. A motion picture was made to show the view from the landing Lunar Excursion Module during the last 10 000 feet of descent. M.W.R.

N66-14770*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A VARIATIONAL METHOD FOR MULTISTAGE LAUNCH VEHICLE OPTIMIZATION
Fred Teren and Omer F. Spurlock Washington, NASA, 1965 31 p refs Presented at the 3d AIAA Aerospace Sci. Meeting, New York, 24–26 Jan. 1966
(NASA-TM-X-52150) CFSTI: HC $2.00/MF $0.50 CSCL 22A

The methods of the calculus of variations are used to maximize payload capability for multistage launch vehicles. The method of solution uses the Lagrange multipliers to determine the optimum thrust direction profile, as well as to construct partial derivatives of payload with respect to the stage propellant loadings and a booster steering parameter. These derivatives are used to terminate the stages and/or as terminal equations to be satisfied. Maximum payload can thus be achieved with a single solution, rather than with a family of parametric results. Constant thrust and specific-impulse operation is assumed for each upper stage (booster thrust and specific impulse vary with atmospheric pressure), and structure weight can be either fixed or a linear function of the stage propellant loading. Two-dimensional flight in a central, inverse-square gravitational field is assumed. Numerical results are presented for two- and three-stage launch vehicles flown to circular orbit and earth escape, respectively. Parametric results are presented and compared with the overall optimum solution obtained by use of the variational technique. Author

N66-14798# RAND Corp., Santa Monica, Calif.
COSMOLOGY IN TERMS OF OBSERVABLES
Dominic G. B. Edelen Oct. 1965 30 p refs
(Contract AF 49(638)-66-C-0001; Proj. RAND)
(RM-4652-PR; AD-623276) CFSTI: HC $2.00/MF $0.50

Under the assumption that the Einstein field equations hold locally (in our stellar neighborhood), a system of field equations is obtained for aggregates through the use of an observation operator. This operator converts any tensor field into a corresponding tensor field of observables and accounts for both intrinsic errors, such as optical resolution, and any loss of information due to averaging or ensemble representations. The aggregate field equations are shown to require a reevaluation of all physical interpretations associated with previous relativistic cosmological models if the Einstein field equations hold locally. A basis for the reevaluation is given, together with conclusions concerning the cosmological metric tensor. In addition, a basic indeterminism in any relativistic cosmology is demonstrated, both in the field equations and in the equations of motion. Author (TAB)

N66-14811# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
APL COORDINATE SYSTEMS AND THEIR RELATION TO ONE ANOTHER
F. T. Heuring 3 Aug. 1964 26 p refs
(Contract NOw-62-0604-c)
(CF-3100; AD-622478) CFSTI: HC $1.00/MF $0.50

Coordinate systems used by APL are an inertial coordinate xed geodetic coordinate system. The inertial coordinate systems is that one in which the satellite is tracked and ephemerides computed; this is described in Section I. The earth-fixed geocentric coordinate system furnishes the 'tie' between the satellite in inertial space and the tracking station of the rotating Earth, and is discussed in Section II. The tracking stations are specified in some geodetic coordinate system which in turn is related to the earth-fixed geocentric coordinate system and is covered in Section III. TAB

N66-14826*# National Aeronautics and Space Administration, Washington, D. C.
NASA 1965 SUMMER CONFERENCE ON LUNAR EXPLORATION AND SCIENCE
1965 448 p refs Conf. held in Falmouth, Mass., 19–31 Jul. 1965
(NASA-SP-88) GPO: HC $1.50; CFSTI: MF $2.25 CSCL 22A

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N66-14827* National Aeronautics and Space Administration, Washington, D. C.
REPORT OF GEODESY/CARTOGRAPHY WORKING GROUP
In its NASA 1965 Summer Conf. on Lunar Exploration and Sci. 1965 p 57–76 (See N66-14826 05-30) GPO: HC $1.50; CFSTI: MF $2.25

Tasks which are essential to the implementation of a lunar geodetic-cartographic program are defined, and general recommendations are made for certain areas which apply to lunar explorations. Camera systems to increase knowledge of lunar geodesy and cartography, an Apollo mapping and survey camera system, and unmanned photography by lunar orbiters are discussed. Other recommendations deal with the gravitational field of the moon, altimetry from lunar orbiting satellites, stellar observations from the lunar surface, and radar/laser ranging from the earth to the moon. A proposal is made for a lunar orbit flight experiment in relation to the acquisition of multipurpose photography; and accuracy required for global variations in lunar topography is discussed. M.W.R.

N66-14828* National Aeronautics and Space Administration, Washington, D. C.
REPORT OF GEOLOGY WORKING GROUP
In its NASA 1965 Summer Conf. on Lunar Exploration and Sci. 1965 p 77–160 (See N66-14826 05-30) GPO: HC $1.50; CFSTI: MF $2.25

The establishment of long-range plans for lunar geological exploration and data-collection programs was considered by eight subgroups of the Geology Working Group. Strategy of

lunar explorations is discussed along with geologic investigations in early Apollo missions, during Apollo surface missions, and from a lunar base. Also considered are geologic mapping of the moon from data acquired by lunar orbiters and use of a long-range laboratory vehicle for post-Apollo Extension System geologic exploration of the moon. Attention is given to geologic training of astronauts and career proficiency maintenance for scientists in the astronaut program. M.W.R.

N66-14829* National Aeronautics and Space Administration, Washington, D. C.
REPORT OF GEOPHYSICS WORKING GROUP
In its NASA 1965 Summer Conf. on Lunar Exploration and Sci. 1965 p 161–221 ref (See N66-14826 05-30) GPO: HC $1.50; CFSTI: MF $2.25

The overall design of a lunar exploration program to reveal the first order physical properties of the moon from surface to center was the major concern of Geophysics Working Group. Experiments which can contribute to the solution of the lunar geophysical problem are discussed. Geophysics experiments on early Apollo missions are characterized and given priorities with details for active and passive seismology studies including tidal gravimetry; heat flow measurements; magnetic studies, and determination of physical properties. Studies on Apollo extension programs deal with active and passive seismology and gravity, magnetic observatory recordings, heat flow measurements, and traverse geophysics. Surface logging on traverses and borehole logging are also discussed. Recommendations for orbital geophysical experiments are concerned with instruments for deep probing and for surface observations. Requirements for data storage and earth-based telemetry support during surface probe operations and beyond are also considered. M.W.R.

N66-14831* National Aeronautics and Space Administration, Washington, D. C.
REPORT OF GEOCHEMISTRY-PETROLOGY WORKING GROUP
In its NASA 1965 Summer Conf. on Lunar Exploration and Sci. 1965 p 245–288 (See N66-14826 05-30) GPO: HC $1.50; CFSTI: MF $2.25

Basic goals in the geochemical, mineralogical, and petrological study of the moon and the role of various Apollo programs are reviewed. A proposed scheme for study of returned lunar samples is presented, along with an evaluation of the proposals. Sampling requirements, methods, and containers are discussed; and design of a Lunar Sample Receiving Laboratory is described. Suggested essential geochemical and petrological measurements on returned lunar samples are concerned with bulk analysis and elemental abundance, isotopes, and phase identification and analysis. Other suggested experiments are classified under desirable but not essential, essential if sample suitable, and valuable if technologically feasible. Sample return from post-Apollo lunar missions and on-site measurements and instrumentation are discussed. Proposed techniques, spectral range, and use of experiments on lunar orbital missions are tabulated, and data processing and other supporting research are considered. M.W.R.

N66-14833* National Aeronautics and Space Administration Washington, D. C.
REPORT OF LUNAR ATMOSPHERES WORKING GROUP
In its NASA 1965 Summer Conf. on Lunar Exploration and Sci. 1965 p 355–366 (See N66-14826 05-30) GPO: HC $1.50; CFSTI: MF $2.25

Maximum direct information on the lunar atmosphere must come from measurements of the neutral components despite the fact that experimental techniques for measuring ionized components are better developed. Total neutral pressure can be determined at present, but major improvements in mass spectrometric devices are required for lunar atmosphere measurements. It is recommended that the ion-generating region for a neutral gas spectrometer employ a technique other than a thermionic emitter in order to avoid outgassing of the system and gettering of the gas molecules. Existing techniques can be used to develop the required devices; the addition of electron multipliers and counting techniques to a quadropole-type instrument can probably supply the required sensitivity. The introduction of coincidence techniques is also recommended. Priorities are established for atmospheric measurements for the first three Apollo measurements. Possible sources of lunar atmosphere are discussed, and contamination is considered. M.W.R.

N66-14834* National Aeronautics and Space Administration, Washington, D. C.
REPORT OF ASTRONOMY STUDY GROUP
In its NASA 1965 Summer Conf. on Lunar Exploration and Sci. 1965 p 367–393 ref (See N66-14826 05-30) GPO: HC $1.50; CFSTI: MF $2.25

A report on the Lunar Exploration System for Apollo (LESA) was reviewed in order to see how the moon could be used for astronomy and to determine what experiments would be feasible. It is recommended that studies be undertaken immediately to explore lunar capabilities for astronomical observations; and these should include engineering studies on earth, environmental studies on the moon, and testing with small telescopes on the moon. Major environmental areas requiring study are discussed for radio, optical, X-ray, and gamma ray astronomy; and numerous experiments are suggested. Discussions of the individual experiments proposed in the LESA report, which are summarized, deal with an LF antenna, galactic radio background and burst detection, various telescopes, Lyman alpha radiation, Einstein shift, an optical corner reflector, and other proposed studies. M.W.R.

N66-14836* National Aeronautics and Space Administration, Washington, D. C.
APOLLO MISSION
R. Walter Cunningham *In its* NASA 1965 Summer Conf. on Lunar Exploration and Sci. 1965 p 407–417 (See N66-14826 05-30) GPO: HC $1.25; CFSTI: MF $2.25

An astronaut presents his views on the operational aspects of proposed lunar surface activities in order to (1) place these activities in perspective with the overall mission, (2) point out some overriding priorities, (3) mention various limitations and constraints, and (4) offer some personal suggestions. The events which take place during the lunar stay portion are outlined from the third mid-course correction on the translunar flight to the completion of the trans-earth injection. A breakdown of activities during this seven-hour stay is given. M.W.R.

N66-14862# RAND Corp., Santa Monica, Calif.
A COMPUTING PROGRAM FOR TRACKING ERROR ANALYSIS OF KEPLERIAN TRAJECTORIES
R. T. Gabler and S. J. Belcher Oct. 1965 54 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-4740-PR; AD-624133) CFSTI: HC $3.00/MF $0.50

This memorandum presents a computer program for determining the accuracy of instrumentation used in estimating the position and velocity of a vehicle in near Keplerian motion. The accuracy with which two coordinates of the tracking stations may be estimated may also be determined. The information from a tracking network which represents an overdetermination of trajectory parameters is assumed to be combined in a general least-squares sense. The results appear as covariance matrices, confidence regions and standard deviations. The computer routine described here computes all partial derivatives from analytic formulas and provides for possible tracking-station motion limited to great-circle paths. Author (TAB)

N66-14889 Library of Congress, Washington, D. C. Aerospace Technology Div.

OPTIMUM ACCELERATION OF A SPACECRAFT IN A CENTRAL FIELD

Leonas Kacinskas *In its* Foreign Sci. Bull., V. 1, No. 12 Dec. 1965 p 8–11 refs (See N66-14887 05-34)

The variational problem of the energy-optimum acceleration of a low-thrust spacecraft in a central gravitational field within the range from a nearly circular orbit velocity to hyperbolic velocity is studied under the assumptions that this acceleration is variable and its direction deviates from the direction of the tangent to the trajectory. The properties of such motion in the neighborhood of the gravitational center and at points distant from the center are analyzed. The energy-optimum motion is compared with the corresponding motion of a spacecraft with constant tangential acceleration, and its advantages and disadvantages are indicated. The construction of the limit solution of the variational problem by which estimation of the basic flight parameters can be reduced to the use of single-entry tables or to calculations of simple formulas is considered. Author

N66-14901*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

LANDING CHARACTERISTICS OF THE APOLLO SPACECRAFT WITH DEPLOYED-HEAT-SHIELD IMPACT ATTENUATION SYSTEMS

Sandy M. Stubbs Washington, NASA, Jan. 1966 55 p refs Film Supplement L-886 is available on loan from NASA Langley Research Center

(NASA-TN-D-3059) CFSTI: HC $3.00/MF $0.50 CSCL 22A

To determine the accelerations and landing characteristics of the Apollo spacecraft command module with two different active landing systems, tests of a 1/4 scale dynamic model were made on water, sand, and a hard clay-gravel composite landing surface for various vertical and horizontal velocities, and landing attitudes simulating parachute letdown. The configuration 1 landing system consisted of six hydraulic struts and eight crushable honeycomb struts; the configuration 2 system was lighter, with four hydraulic struts and six strain straps. Accelerations for configuration 2 were generally equal to or lower than accelerations for configuration 1, and normal and longitudinal accelerations for both were considered to be below human acceleration tolerance limits without using crew-couch shock absorbers or other load alleviation devices. The stability envelopes for configuration 1 were generally slightly larger than those for configuration 2, and stability characteristics for both indicate that roll control of the spacecraft would be desirable. The landing system mass estimates for both configurations are tabulated, and conversion factors relating U.S. customary units to the International System of Units are listed. M.G.J.

N66-14902*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A STUDY OF THE ACCURACY OF ESTIMATING THE ORBITAL ELEMENTS OF A LUNAR SATELLITE BY USING RANGE AND RANGE-RATE MEASUREMENTS

Harold R. Compton Washington, NASA, Jan. 1966 41 p refs (NASA-TN-D-3140) CFSTI: HC $2.00/MF $0.50 CSCL 22C

A parametric study has been made to determine the effects of tracking mode and orbital parameters on the accuracy of determining the state of a lunar satellite. A comparison of the relative advantage of using either range or range-rate measurements was made, and the results indicate that the advantage of one data type over the other is very dependent on the semimajor axis and somewhat dependent on the modal position and eccentricity but is not dependent on the inclination. It was also found that range and range-rate measurements are similar data types in that they produce similar correlation matrices for the state variables and simultaneous use of both data types does not significantly reduce correlations between the elements. Over a range of inclination angles from 2° to 40° with respect to the earth–moon plane, the results showed that the accuracy of determining the orientation angles increased as the inclination increased whereas the accuracy of determining the in-plane variables remained nearly constant. The effects of variations in the nodal position on the accuracy of determining the orbital elements were found to be periodic. It was also found that the accuracy of estimating the elements increased with an increase in eccentricity. Author

N66-14911*# National Aeronautics and Space Administration, Washington, D. C.

ANCIENT NOVAE AND SUPERNOVAE RECORDED IN THE ANNALS OF CHINA, KOREA, AND JAPAN AND THEIR SIGNIFICANCE IN RADIOASTRONOMY

Ze-Zong Xi and Shu-ren Bo Jan. 1966 56 p refs Transl. into ENGLISH from Tien Wen Hsueh Pao (Guozi Shudian), v. 13, no. 1, 1965 p 1–21

(NASA-TT-F-388) CFSTI: HC $3.00/MF $0.50 CSCL 03B

This paper presents a revised catalog of ancient novae. The first section describes the criteria of selecting the items which may be regarded as nova and gives the resulting list. In the second section are discussed 12 possible supernovae and their identification with 11 radio point sources. The third section deals with the spatial distribution of supernovae and it is found that the frequency of occurrence of supernova in the Milky Way is about one in every 50 years on the average. Author

N66-14959*# Arizona Univ., Tucson.

COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY, VOLUME 3, NO. 41-49

1965 77 p refs

(Grants NsG-161; NsG-487)

(NASA-CR-69204) CFSTI: HC $3.00/MF $0.75 CSCL 03A

Research activities pertaining to lunar and planetary sciences are reported. The period of revolution of Miranda, a satellite of the planet Uranus, was reevaluated from plate measurements obtained by an 82-inch reflector telescope; the orbit of Comet 1947 VI (Wirtanen) was calculated to be elliptical on the basis of an improved least squares adjustment of the elements; preliminary drawings of lunar limb areas are depicted; and photographs of volcanic sublimates on earth with relevance to the lunar surface, are presented. In addition, numerical calculations for a wide angle filter lens were made; and experimental investigations on electrostatic filter lenses with wide image angles were made. Also discussed are the transmittances of some optical materials for use between 1900 Å and 3400 Å. The geographic coordinates of an observatory station were determined. L.S.

N66-14962*# Ohio State Univ. Research Foundation, Columbus. Antenna Lab.

TWO EXPERIMENTS YIELDING LUNAR SURFACE INFORMATION EMPLOYING POLARIZED RADAR WAVES

Donald E. Barrick 15 Aug. 1965 62 p refs *Its* Rept.-1388-17 (Contract NsG-213)

(NASA-CR-69202) CFSTI: HC $3.00/MF $0.75 CSCL 03A

Two experiments are discussed which permit the determination of the local statistical backscattering properties of the lunar surface or the surface of another planet. The first experiment employs the return from a range ring of the moon, i.e., the fact that a transmitted radar pulse of the proper length illuminates only a certain well-defined annular portion of the lunar surface at a time. The second experiment makes use of the doppler spreading of a discrete CW incident wave upon the lunar surface which is moving (rotating and translating) in a predetermined manner. The value in obtaining these local statistical backscattering properties is that they can be compared directly to similar properties of a variety of surface samples from the earth. From this comparison one can learn more about lunar surface composition, roughness, and average dimensions of surface features without having to rely upon the assumption of a certain model or theory of scattering in the formulation of the problem. Author

N66-14968*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.

STUDY OF THE FEASIBILITY OF AN EARLY LUNAR FLARE Final Report

Jul. 1964 139 p

(Contract NAS7-281)

(NASA-CR-69194; SM-47954) CFSTI: HC $4.00/MF $1.00 CSCL 22A

Static and dynamic compatibility, mixture-ratio combustion, air combustion, impact, and spectroscopic tests were conducted on candidate materials for establishing the technical feasibility of using a high-temperature chemical flare concept for determining the approximate chemical and physical characteristics of simulated lunar surface materials. The combustion test results indicate that a slightly aluminum-rich mixture-ratio gives the best performance, and when extrapolated to lunar flare size, should give a light yield adequate for observation from earth. Soil penetration tests together with spectroscopic tests confirm the fact that light yield decreases with an increase of depth showing the importance of having a low area-density flare to minimize this effect. Results obtained in light gas gun impact tests indicate that flare initiation does occur when impacting a hard or soft target at lunar impact speeds. Other analyses of test results are also made, and recommendations are given. L.S.

N66-14971# Library of Congress, Washington, D. C. Aerospace Technology Div.

SOVIET LONG-RANGE SPACE EXPLORATION PROGRAM Surveys of Communist World Scientific and Technical Literature

Vladimir Mutschall 30 Dec. 1965 37 p refs *Its* Analytical Survey

(ATD-65-94)

Problems of interplanetary space exploration are discussed. These include spacecraft navigation and guidance, stability and control, tracking, and landing operation problems. Also discussed are various types of power sources for spacecraft engines. In addition, extraterrestrial contacts with other civilizations in the universe via radio communication is discussed. L.S.

N66-14972*# American Science and Engineering, Inc., Cambridge, Mass.

SOME OBSERVATIONAL ASPECTS OF X-RAY ASTRONOMY

Riccardo Giacconi, H. Gursky, J. R. Waters, B. Rossi, G. Clark (MIT) et al Jul. 1965 79 p refs

(Contract NASw-898; Grant NsG-386; Contract AT(30-1)-2098)

(NASA-CR-69224; ASE-1003B) CFSTI: HC $3.00/MF $0.75 CSCL 03A

Rocket and balloon flights with instrumentation aboard were carried out to pinpoint X-ray sources, and to observe X-rays from celestial bodies. Geiger and scintillation counters, photoelectric detectors, collimators, and telescopes were utilized for detecting the X-rays from interstellar space. Frames of reference problems for the rocket observations are analyzed; and X-ray source data are mapped and recorded in terms of pulse height distributions. L.S.

N66-15052*# Hawaii Inst. of Geophysics, Honolulu. Astrogeophysics Div.

ZODIACAL LIGHT Summary Report

J. L. Weinberg 3 Aug. 1964 21 p refs

(Grant NsG-676)

(NASA-CR-58323; HIG-64-11) CFSTI: HC $1.00/MF $0.50 CSCL 03A

A survey is presented in the form of tables and graphs of the surface brightness (radiance) and the degree of polarization of the zodiacal light as a function of elongation in the plane of the elliptic. Numerical results are given, and the spectral region or effective wavelength is specified whenever possible. A bibliography is included of zodiacal light and gegenschein references during the period January 1961 through June 1964. Also included are papers on closely related problems which make use of zodiacal light results. C.T.C.

N66-15055*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A STUDY OF LUNAR LANDING SITES AND ASSOCIATED STAY TIMES

Laurence W. Enderson, Jr. Washington, NASA, May 1965 38 p refs

(NASA-TN-D-2795) CFSTI: HC $2.00/MF $0.50 CSCL 22A

A study utilizing the results of a patched conic approximation was conducted to determine the possible landing sites and associated stay times on the lunar surface that are compatible with the lunar-orbit-rendezvous technique. Particular emphasis is placed on landing sites that allow a return to the established lunar orbit at all times during the exploration period. Three different landing and take-off maneuvers are considered as well as the effect of variations of the energy and inclination of the earth-to-moon transfer trajectory. Consideration is given to maneuvers that permit the most flexibility in selection of landing sites as well as maneuvers that allow the longest stay time on the lunar surface for a given total plane-change capability. The results of this study indicate that the landing sites and associated stay times are strongly dependent on the inclination of the established lunar orbit as well as the specific landing and take-off maneuvers that are employed. If the inclination of the established lunar orbit is constrained to equal the sum of the landing-site latitude ϕ and the plane-change capability δ, much versatility exists in the selection of possible landing sites on the lunar surface and in the corresponding stay times. Employment of a plane-change capability during the take-off maneuver allows extended exploration periods and provides an inherent safety factor for the mission. Author

N66-15059*# Philco Corp., Palo Alto, Calif. WDL Div.
COMET AND CLOSE-APPROACH ASTEROID MISSION STUDY. VOLUME 4: SPACECRAFT SYSTEM EVALUATION Final Report, 2 Jul. 1964–2 Jan. 1965
Albert Giddis 2 Jan. 1965 26 p refs Prepared for JPL (Contracts NAS7-100; JPL-950870)
(NASA-CR-57096; WDL-TR2366, Vol. 4) CFSTI: HC $1.00/MF $0.50 CSCL 22A

Data based on environmental specifications for the Centaur stage boostered by the Atlas launch vehicle are presented. Mission constraints for the design of conceptual spacecraft to accomplish the Comet Mission objectives, and the sequence of events for the photovoltaic configuration are also tabulated. The criteria established for evaluating system capability are based on the following key parameters: (1) weight of science, (2) aiming error, and (3) bit rate. R.W.H.

N66-15068*# Southwest Center for Advanced Studies, Dallas, Tex.
MULTIDISCIPLINARY RESEARCH IN SPACE-RELATED SCIENCE AND TECHNOLOGY Semiannual Report
30 Sep. 1965 108 p refs Supported in part by AF, Navy and NSF
(Grant NsG-269-62)
(NASA-CR-69137; EPS-65-2) CFSTI: HC $4.00/MF $0.75 CSCL 03B

A summary of studies is presented which were made to develop an understanding of the earth and its atmosphere, and the processes by which it reached its present state. This study also applies to the planets, the moon, and the interplanetary or solar environment in which they are located. Consideration is given to such areas as atmospheric structure, plasmas, geomagnetic variations, energetic particles, auroral current systems, interplanetary physics, infrared studies, and kinetic theory. C.T.C.

N66-15146# Royal Aircraft Establishment, Farnborough (England).
THE ORBIT OF TIROS 7 (1963-24A) FEBRUARY 13–23, 1965
Diana W. Scott Oct. 1965 26 p refs
(RAE-TR-65221) CFSTI: HC $2.00/MF $0.50

The orbit of Tiros 7 has been determined from Minitrack observations for part of February 1965, using the RAE orbit improvement programme. A table of orbital parameters is given for 7 nodes spaced at 25-node intervals. The orbital elements are compared with those given by the NASA orbit of the satellite. Author

N66-15190# Aeronautical Research Associates of Princeton, Inc., N. J.
A STUDY OF TIME-OPTIMAL RENDEZVOUS IN THREE DIMENSIONS, VOLUME I Final Report, 15 Apr. 1963–15 Apr. 1964
Bernard H. Paiewonsky and Peter J. Woodrow Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Jan. 1965 92 p refs
(Contract AF 33(657)-11319)
(AFFDL-TR-65-20, Vol. I; ARAP-69, Vol. I; AD-624218) CFSTI: HC $3.00/MF $0.75

The results of a study of time optimal rendezvous in three dimensions with bounds on the rocket thrust and the available propellant are described. The equations of motion are linearized and Neustadt's method is used to solve the two-point boundary value problem in the seven-dimensional state space. Three convergence acceleration schemes are studied. Examples of terminal rendezvous paths are presented and discussed in terms of the magnitudes of the bounds on thrust and fuel. The dependence of terminal errors on initial measurement errors in position and velocity is also discussed. The range of initial values include position errors up to 25 miles and relative velocity errors of 200 ft/sec. The thrust accelerations of the rockets are on the order of 1 ft/sec-sq; the propellant bounds (ideal characteristic velocities) range between 600 ft/sec and 250 ft/sec. Author (TAB)

N66-15192*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.
EFFICIENT PLANETARY PARKING ORBITS WITH EXAMPLES FOR MARS
Roger W. Luidens and Brent A. Miller Washington, NASA, Jan. 1966 40 p refs
(NASA-TN-D-3220) CFSTI: HC $2.00/MF $0.50 CSCL 22C

The weight required in an initial low Earth parking orbit to accomplish an interplanetary round trip or one-way capture mission is exponentially related to the required propulsive velocity increment ΔV. This total mission ΔV can be reduced by the selection of an efficient parking orbit at the destination planet. This report presents (1) several new types of parking orbits that yield low ΔV's, (2) a comparison of various parking orbits on the basis of mission ΔV; and (3) the factors that determine when each type of parking orbit is applicable. The study assumed Keplerian trajectories and impulsive thrusting. The problems of landing and ascent from the planet surface to the parking orbit are considered. (The term "parking orbit" as used here includes the associated approach and departure trajectories as well as the parking orbit itself.) Round trips to Mars in 1979–1980 with total trip durations of 300 to 1000 days were selected to illustrate the parking orbits investigated. For these trips, reductions in ΔV of up to 30 percent were achieved by using elliptic rather than circular parking orbits. Two efficient means of obtaining the required direction of the Earth return trajectory from the parking orbit are (1) by arriving at and departing from the parking ellipse at positions away from the ellipse periapsis, or (2) by using a parking ellipse that is out of the plane of the interplanetary trajectories and then rotating the plane of the parking ellipse about the line of apsides. Elliptic parking orbits will give even larger reductions in ΔV for the more massive planets. Author

N66-15198# Lockheed Missiles and Space Co., Sunnyvale, Calif.
CONTROL PROGRAMS FOR ATMOSPHERIC RE-ENTRY AT SUPER-CIRCULAR VELOCITY
V. M. Ponomarev [1965] 10 p refs Transl. into ENGLISH from the book "Control Theory for Space Vehicle Motion" Moscow, Nauka Press, 1965

The problem of utilizing aerodynamic forces to decelerate a space vehicle reentering the atmosphere at a super-circular velocity is reviewed and the control program for the case of a let-down without emergence from a dense atmosphere is considered in detail. The dependence of the character of the let-down on the reentry angle into the dense atmosphere is shown for various conditions of initial velocity. Also, the dependence of the maximum overload on the reentry angle into the atmosphere for certain initial conditions is shown. Programmed changes in the motion parameters for a ballistic let-down with an initial angle of $-4.4°$ is given. Further, the dependence of the maximum heat flux at the stagnation point and the total quantity of delivered heat on the reentry angle into the dense atmosphere for a ballistic let-down into earth's atmosphere is presented. It is shown that in principle it is possible to find various control programs for the let-down into the atmosphere at a super-circular initial velocity. E.E.G.

N66-15199*# Bellcomm, Inc., Washington, D. C.
A METHOD FOR COMPUTING CHARACTERISTIC VELOCITIES IN AN ORBITAL TRANSFER MANEUVER AND ITS APPLICATION TO THE ESTABLISHMENT OF A LUNAR PARKING ORBIT
R. Y. Pei 7 Dec. 1965 36 p refs
(NASA-CR-69226; TM-65-1013-3) CFSTI: HC $2.00/MF $0.50 CSCL 22C

The problem of a two-impulse orbital transfer maneuver is formulated graphically and analytically. With certain approximations, it is applied to the establishment of a lunar parking orbit. It is shown that to achieve a given parking orbit, the preferred orientation of the transfer orbital plane may be readily derived. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N66-14360# International Geophysical Year World Data Center A, Washington, D. C. Rockets and Satellites.
ROCKETS AND SATELLITES Catalogue of Data, 1 Jan.–30 Jun. 1965
Sep. 1965 25 p

Data on sounding rockets, artificial satellites, and space probes received at the World Data Center in the United States during the first six months of 1965 are presented. A complete list of rocket and scientific satellite launchings throughout the world is included; and miscellaneous satellite observations by visual, photographic, and radio methods are tabulated. A subject index of reports and reprints includes a compilation of positional observations by countries; and references on orbits, trajectories, data recovery, geodesy, atmospheric and ionospheric physics, radiation, astronomy, and other related subjects. M.W.R.

N66-14526*# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
A STUDY TO DEFINE A STATE-OF-THE-ART ROCKET VEHICLE SUITABLE FOR SYNOPTIC METEOROLOGICAL SOUNDINGS, VOLUME 1 Final Report
18 Jun. 1965 136 p refs Revised
(Contract NAS1-4427)
(NASA-CR-66002, Vol. I; SID-65-411-1A) CFSTI: HC $4.00/MF $1.00 CSCL 16C

Four candidate meteorological sounding rocket system approaches are evaluated for high reliability attainment of apogee altitude under relatively severe surface wind environments and within given launch angle restrictions. The four systems include (1) single stage with payload attached to apogee; (2) single propulsive stage with stabilized, nonpropulsive payload separated at burn-out; (3) single-stage system with a continuous-burn, dual-thrust level motor; (4) two-propulsive-stage system. Under the study ground rules and with consideration of comparative performance, growth, reliability, and production cost factors, the single-stage system with payload separated at apogee is judged the most feasible, and a preliminary design and evaluation of the selected concept is presented. Author

N66-14702*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER-VENUS 1962 Final Project Report
Washington, NASA, 1965 380 p refs
(Contract NAS7-100)
(NASA-SP-59) GPO: HC $2.00; CFSTI: MF $2.00 CSCL 22B

A presentation of the Mariner-Venus probe II is given and its various problems, solutions, difficulties, and successes are discussed in depth. The following topics were observed: (1) *History of Knowledge About Planet Venus;* (2) *Project Organization and Management;* (3) *Space Vehicle System;* (4) *Trajectory and Orbit;* (5) *The Mariner Mission;* (6) *Performance of Mariner II Subsystems;* (7) *Tracking and Data Acquisition Operations;* and (8) *Scientific Results.* G.G.

N66-14817# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ELECTRONIC ANALOG SIMULATION OF SATELLITE THERMAL AND POWER SYSTEM CHARACTERISTICS
R. M. Vernon 15 May 1964 66 p refs
(Contract NOw-62-0604-c)
(CF-3087; AD-622481) CFSTI: HC $3.00/MF $0.75

Those parameters are determined in the thermal and power system design that adversely affect the operation of the charge regulator system of an orbiting satellite. Because of the extensive systems evaluation which was required to obtain this objective, a major out-growth of this study was the generation of an electronic analog method of satellite performance simulation which may be applied to both satellite systems design and orbital evaluation. Initially simple models of the charge regulator system were chosen for analytical evaluation by hand and digital computer calculations. These methods were found to be inadequate due to both the simplicity of assumed models and the length of time required for calculations. A description is presented of the satellite design characteristics which were simulated, the method of simulation and the results of a parametric study of satellite operation under various conditions. TAB

N66-14910*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
A COMPENDIUM OF AEROBEE SOUNDING ROCKET LAUNCHINGS FROM 1959 THROUGH 1963
Jon R. Busse and Merrill T. Leffler Washington, NASA, Jan. 1966 176 p refs
(NASA-TR-R-226) CFSTI: HC $5.00/MF $1.00 CSCL 22B

This report summarizes actual vehicle performance data compiled for Aerobee sounding rockets. Additionally, specific information pertaining to problem areas encountered during flights, which were due to malfunction or other difficulties, is included. Other information is provided concerning general Aerobee vehicle configuration, ancilliary hardware, and performance statistics. Data is presented as reference material for reviewing vehicle performance on past experiments, and for use by all scientists interested in obtaining expected performance characteristics with Aerobee vehicles on future scientific space probes. Author

N66-14951*# Lear Siegler, Inc., Grand Rapids, Mich. Instrument Div.
LAUNCH VEHICLE OPTIMIZATION, PHASE II. VOLUME II: TECHNIQUES DEVELOPMENT
Sep. 1965 627 p refs
(Contract NASw-938)
(NASA-CR-69212; GR-65-1089-II) CFSTI: HC $9.27/MF $3.00 CSCL 22D

The results of technique developments in performance, reliability, economics, launch vehicle system, regression, and optimization as related to the overall PRESTO (Performance, Reliability, and Economics Simulation Techniques for Optimization) concept synthesis are reported. System simulation techniques necessary to generate mathematical models describing the system characteristics for performance, reliability, and economics systems are presented. The models are required to have some independent system variables in common for overall concept implementation. A definition of a study launch vehicle system to which a modification of the PRESTO concept was applied for demonstration purposes, is given. In addition, a technique is presented for an approach to multiple regression curve fitting of data on a set of system parameters in order to generate an expression describing the behavior of one of the parameters in terms of the remaining independent parameters. This technique can be used in conjunction with any one or all of the performance, reliability, and economics simulators in developing mathematical models of the various system characteristics. A technique is also presented in which the models may be used to lead to desired optimal characteristics. L.S.

N66-14966*# Lear Siegler, Inc., Grand Rapids, Mich. Instrument Div.
LAUNCH VEHICLE OPTIMIZATION, PHASE II. VOLUME I: CONCEPT DEVELOPMENT AND APPLICATION Final Report
Sep. 1965 131 p
(Contract NASw-938)
(NASA-CR-69197; GRR-65-1089-I) CFSTI: HC $4.00/MF $1.00 CSCL 22D

This report presents and discusses a philosophy for solution of the complicated Launch Vehicle Optimization (LVO) problem and the results of an application of this philosophy to a real system—a selected Study Launch Vehicle Systems (SLVS). This specific application was designed to demonstrate the feasibility and capability of the approach. The described philosophy for solution is called the PRESTO concept (for Performance, Reliability and Economics Simulation Techniques for Optimization). Author

N66-15066*# Michigan Univ., Ann Arbor.
LAUNCH VEHICLE OPTIMIZATION, PHASE II. VOLUME III: TECHNIQUES DEVELOPMENT Final Report
Sep. 1965 294 p Prepared for Lear Siegler, Inc., Grand Rapids, Mich.
(Contract NASw-938)
(NASA-CR-69214; GRR-65-1089-III) CFSTI: HC $6.00/MF $1.50 CSCL 22D

This report contains documentation of a unique approach to the simulation of the behavior of complex physical systems, performed as part of a Launch Vehicle System Optimization (LVO) program. This approach has been adapted to a digital computer and is known as the performance simulator. The methodology utilized within the simulator in solving the system problem is one which proceeds from desired results through an analysis of an element descriptor library to form an algorithm which models system performance in terms of known input parameters. The most critical portion of the methodology is the compilation of the element descriptor library which contains the physical laws governing the behavior of the constituent elements of the system. An ancillary program, regression, which may be utilized in developing the library, is also documented in this volume. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N66-14354# Lockheed Missiles and Space Co., Sunnyvale, Calif.
FLUTTER OF A CIRCULAR CONICAL SANDWICH SHELL
E. I. Grigoliuk and A. P. Mikhailov [1965] 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, v. 163, no. 5, 1965 p 1100–1103

Consideration is given to the stability of an elastic circular conical sandwich shell, with a hard transverse shear-resistant filler, around which a supersonic flow streams. The equation is given for describing small transverse vibrations of such a shell with nonsymmetrical structural thickness, and the problem is formulated. A solution is offered for the original system and the linear piston theory accounts for the aerodynamic stream pressure. Critical flow pressures and velocities are determined by investigation of the matrix eigenvalues of a system with homogeneous equations, which are obtained by use of the Bubnov method to the linear dynamic equations of shallow shell theory. M.W.R.

N66-14386*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE GENERAL INSTABILITY OF RING-STIFFENED CORRUGATED CYLINDERS UNDER AXIAL COMPRESSION
John N. Dickson and Richard H. Brolliar Washington, NASA, Jan. 1966 37 p refs
(NASA-TN-D-3089) CFSTI: HC $2.00/MF $0.50 CSCL 20K

A method is presented to determine the general instability load of a ring-stiffened corrugated cylinder under axial compression. This method is developed using linear small deflection theory. The stiffness properties of the rings are uniformly distributed along the cylinder and the eccentricity of the rings with respect to the corrugation centerline is taken into account. Analytical and experimental results are compared. In this comparison good agreement is obtained for cylinders loaded in pure compression. For the cylinders subjected to bending or a combination of bending and compression the analytical calculations are conservative. A computer program for the application of this method has been developed. The program and an explanation of its notation are included in this report. Author

N66-14397# Whittaker Corp., San Diego, Calif. Narmco Research and Development Div.
MECHANICAL RELATIONSHIP OF REINFORCEMENTS AND THE BINDER MATRIX Final Report, 10 Jun. 1964–1 Mar. 1965
Juan Haener Ft. Eustis, Va., Army Aviation Mater. Labs. Sep. 1965 161 p refs
(Contract DA-44-177-AMC-208(T))
(USAAVLABS-TR-65-58; AD-623130) CFSTI: HC $5.00/MF $1.00

The mechanical interactions between reinforcement and matrix in a composite under load have been described by stress distribution equations in the fibers and in the matrix. Although special attention has been given to stresses resulting from polymerization and temperature shrinkage, the solution obtained can be easily adapted for use with the boundary conditions of external loads. Several cases were considered: (1) a cylindrical filament of finite length embedded in a resin cylinder; (2) a cylindrical filament of infinite length embedded

in a resin cylinder; and (3) a matrix supporting a central fiber surrounded by six symmetrically spaced fibers, each in turn surrounded by six others. Author (TAB)

N66-14407# Martin Co., Baltimore, Md. Space Systems Div.

THEORETICAL AND EXPERIMENTAL COMPARISON OF INFLUENCE COEFFICIENTS AND VIBRATION MODES OF A BUILT-UP 45° DELTA WING

S. Kaufman and D. B. Hall Sep. 1963 38 p refs
(RM-131)

Deflection influence coefficients, mode shapes, and frequencies have been computed for a 45° delta wing using a force matrix method developed for digital computation. The first five free–free symmetrical modes obtained by this method show good agreement with results from tests conducted by NASA on an identical wing. These computed results are also compared with results obtained by other theoretical methods. The static deflections and vibratory deflections in the first four modes were compared statistically. For the wing locations selected, comparison of calculated and measured deflections showed close agreement. For the static deflections, an RMS error of 3.5% was obtained. For vibratory deflections (at the lowest frequency) the RMS error was 5.5% and increased as the frequency increased. From these comparisons, it is concluded that the method of determining compliances, and the procedures for computing influence coefficients, mode shapes, and frequencies are valid and accurate within the limitations of the number of network grid points selected. Author

N66-14451# Army Materials Research Agency, Watertown, Mass. Materials Engineering Div.

TRANSITION SOLUTIONS FOR AXISYMMETRIC SHELL VIBRATIONS

Edward W. Ross, Jr. Oct. 1965 40 p refs
(AMRA-TR-65-27; AD-623638) CFSTI: HC $2.00/MF $0.50

The report describes an investigation of the solutions of a sixth-order linear, ordinary differential equation system near a transition point in their asymptotic representations. The system is the one which describes the small, axisymmetric vibrations of an elastic thin shell. Representations valid in the transition region are found for all six solutions, connection formulas are stated, and the possibility of uniform asymptotic approximations is discussed briefly. Author (TAB)

N66-14565# Texas Univ., Austin. Defense Research Lab.

EXPERIMENTAL DETERMINATION OF FREQUENCIES AND MODE SHAPES OF CANTILEVER AND HUB-PIN PLATES

R. R. Craig, H. J. Plass, Jr., and D. A. Caughfield Jun. 1964 70 p refs
(Contract NOrd-16498)
(DRL-518; CR-13; AD-622495) CFSTI: HC $3.00/MF $0.75

The report contains experimental data on the frequencies and mode shapes of vibrating plates. Data for the following plates are presented: a square cantilever plate; skew cantilever plates having sweep-back angles of 15, 30, 45, and 60°; triangular cantilever plates having aspect ratios of 2 (45° triangle), 3.3, and 4; a square hub-pin plate; and a 45° triangle hub-pin plate. Electrical and mechanical improvements to the system are described. Author (TAB)

N66-14576*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

STIFFNESS MATRIX STRUCTURAL ANALYSIS

B. Wada 31 Oct. 1965 55 p refs
(Contract NAS7-100)
(NASA-CR-68998; JPL-TR-32-774) CFSTI: HC $3.00/MF $0.50 CSCL 20K

A computer program is described that solves structural problems having lumped masses connected by weightless members. The program is capable of handling 130 degrees of freedom with the option of using any one of five different member types. Using the stiffness formulation, static deflections and loads, thermal deflections and loads, eigenvalues and eigenvectors can be evaluated. Author

N66-14585# Naval Ordnance Test Station, China Lake, Calif.

THE BLAST ENVIRONMENT: METHODOLOGY AND INSTRUMENTATION TECHNIQUES WITH APPLICATIONS TO NEW FACILITIES

E. A. Zeitlin Aug. 1965 94 p refs
(NAVWEPS-8782; NOTS-TP-3870; AD-622980) CFSTI: HC $3.00/MF $0.75

The report reviews and summarizes the blast characteristics usually considered in engineering studies in terms of blast aerodynamic forces and the commonly accepted scaling laws. The similarity and points of difference between blast and earthquake forces are discussed. The equations of structural dynamics, vibration characteristics, and basic types of available instruments are examined as a part of a unified dynamic system consisting of the test structure, pickup devices, and recording methods. Author (TAB)

N66-14630*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

STRESS MEASUREMENTS ON BLAIR HIGH SCHOOL GYMNASIUM: A DEMONSTRATION OF SPACE TECHNOLOGY TRANSFER

D. Kastel 1 Nov. 1965 18 p refs
(Contract NAS7-100)
(NASA-CR-68996; JPL-TR-32-837) CFSTI: HC $1.00/MF $0.50 CSCL 13M

An actual demonstration of transfer to nonspace use of technologies developed for space programs applications is described. Techniques used in assessing static and dynamic characteristics of the Blair High School gymnasium involved data acquisition by continuous scanning of strain gauge data acquired over a time of wide-temperature range, and analysis by a computer routine. The advantage of this method over conventional structural testing of uniquely designed structures was proved. More importantly, the process of demonstration was shown to be of great assistance to, and extension of, normal methods of disseminating information of new technologies. It is felt that significant benefit will derive from this improved mode of concept transfer. Author

N66-14632*# Northrop Space Labs., Huntsville, Ala. Research and Analysis Section.

FORTRAN IV COMPUTER PROGRAM FOR THE EVALUATION OF NATURAL FREQUENCIES AND UNSTABLE VALUES OF THE THRUST FREQUENCY FOR A FREE–FREE, CIRCULAR CYLINDRICAL SHELL SUBJECTED TO A GIMBALED, PERIODICALLY-VARYING END THRUST

A. D. Merville, C. M. Pearson, and J. H. Kincaid Sep. 1965 155 p refs *Its* Tech. Memo. No. 124
(Contract NAS8-11255)
(NASA-CR-69111; E20-141) CFSTI: HC $5.00/MF $1.00 CSCL 20K

A Fortran IV computer program that evaluates the natural frequencies of a thin cylindrical shell with free–free end conditions and then evaluates unstable values of the thrust frequency for given initial conditions is presented. This Fortran IV computer program is operationally compatible with the Fortran Processors of the IBM 7094 and the Univac 1107 digital computers. Author

N66-14653# Southwest Research Inst., San Antonio, Tex.
PRELIMINARY LITERATURE SURVEY: STUDIES OF THE STRUCTURAL RESPONSE OF SIMULATED HELICOPTER ROTOR BLADES TO RANDOM EXCITATION Interim Technical Report No. 1
John F. Dalzell and John F. Gormley Sep. 1965 23 p refs
(Contract DA-31-124-ARO(D)-375)
(AROD-5598.1; AD-471209)

This interim technical report is intended to summarize the extent and results of the preliminary literature search which forms the first subphase of the present program of research on the structural response of simulated helicopter rotor blades to random excitation. The objective of the survey was to assess better what data and analytical techniques are available and to verify as far as possible, our original conclusion that the contemplated experimental work has not been, or is not being, duplicated. No indication was found that the program presently envisioned will duplicate existing work. By-and-large, the necessary analytical background appears available; the major problems in the present program remain in the realm of experimental technique. Author

N66-14713*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PLANE THERMOELASTIC DEFORMATION OF INTERNALLY HEATED ANNULAR DISKS OR HOLLOW CYLINDERS
Franklyn B. Fuller Washington, NASA, Jan. 1966 49 p refs
(NASA-TR-R-229) CFSTI: HC $2.00/MF $0.50 CSCL 20K

A plane elastic problem of bodies bounded by concentric circles and heated at the inner boundary is solved in the "uncoupled, quasi-static" approximation. The heating takes place by surface heat transfer, with limiting cases corresponding to sudden temperature change and to constant flux of heat. The stress boundary conditions treated are those of constant pressure at the inner wall while the outer wall may be either free or rigidly restrained. The time-dependent results for stresses, displacement, and temperature are calculated and shown for several cases with varying values for the parameters specifying heat transfer and wall thickness. The effect of varying Poisson's ratio is also examined. Formulas for steady-state distributions of the quantities of interest are also given, as well as some approximate results that can be used for very small times. Author

N66-14719# Allied Research Associates, Inc., Concord, Mass.
GENERAL INSTABILITY OF ORTHOTROPICALLY STIFFENED CYLINDERS. PART I: AXIAL COMPRESSION, TORSION AND HYDROSTATIC PRESSURE LOADINGS Technical Report, Nov. 1963–Jun. 1965
Roger Milligan, George Gerard, C. Lakshmikantham, and Herbert Becker Wright-Patterson AFB, Ohio. AF Flight Dyn. Lab., Jul. 1965 122 p refs
(Contract AF 33(615)-1228)
(ARA-TR-258-2; AFFDL-TR-65-161, Pt. I; AD-623801)
CFSTI: HC $4.00/MF $0.75

The general applicability of orthotropic stability theory to aerospace shell structures was examined experimentally. For this purpose a series of careful experiments were performed on orthotropically stiffened cylinders designed to fail in the elastic general instability mode under three separate loading conditions: axial compression, torsion and hydrostatic pressure. Experimental results obtained during the program verified that for all loading conditions considered linear orthotropic theory results in accurate predictions of cylinder strength. As a result of observed discrepancies between experiment and previously existing theory for longitudinally stiffened cylinders under axial compression, theoretical studies were initiated which resulted in the discovery of a new asymmetric failure mode for this cylinder configuration. Based on this new failure mode, good correlation between experiment and theory was obtained except when the longitudinal stiffened cylinder configurations approached that corresponding to an isotropic cylinder. Other theoretical investigations performed during the program established that cylinder boundary conditions have a pronounced effect on the buckling strength of orthotropic cylinders under hydrostatic pressure loading. Author

N66-14724# Allied Research Associates, Inc., Concord, Mass.
GENERAL INSTABILITY OF ORTHOTROPICALLY STIFFENED CYLINDERS. PART II: BENDING AND COMBINED COMPRESSION AND BENDING
C. Lakshmikantham, George Gerard, and Roger Milligan Wright-Patterson AFB, Ohio. AF Flight Dyn. Lab., Aug. 1965 48 p refs
(Contract AF 33(615)-1228)
(ARA-TR-258-3; AFFDL-TR-65-161, Pt. II; AD-623810)
CFSTI: HC $3.00/MF $0.50

As part of a general program to determine the applicability of linear orthotropic theory to the design of cylindrical shells under various loading conditions, a theoretical and experimental investigation was performed on the general instability of orthotropic cylinders under bending and combined axial compression and bending loading. Based on a simple approximation for the asymmetric buckling pattern, theoretical results suitable for design use were obtained for the buckling of orthotropic cylinders for both bending and combined loading conditions. It was shown that the buckling stress for orthotropic cylinders under bending or axial compression loading are equal which agrees with previous results for isotropic cylinders. Theoretical results were evaluated by means of a series of careful experiments performed on orthotropically stiffened cylinders designed to fail in the elastic general instability mode, for both bending loading and the combined axial and bending loading condition. Experimental results were in good agreement with the theory. Author (TAB)

N66-14765*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESULTS OF HYPERVELOCITY IMPACTS INTO SPACE RADIATOR MATERIALS
Nestor Clough, James H. Diedrich, and Seymour Lieblein Washinton, NASA, 1965 40 p refs Presented at the 1st Rankine Cycle Space Power Systems Specialists Conf., sponsored by AIAA, Cleveland, 26–28 Oct. 1965
(NASA-TM-X-52142) CFSTI: HC $2.00/MF $0.50 CSCL 20K

The results of an experimental hypervelocity impact program designed to evaluate various materials as armor for waste-heat radiator applications are discussed. Total damage, such as dimple, spall, and perforation, as well as simple cratering, was investigated in both flat plate and tubular targets. Projectiles of approximately 0.016 and 0.040 gram were accelerated to velocities of nominally 25 000 feet per

second and impacted against various materials and configurations at room and elevated temperatures. The materials investigated include various aluminum alloys, stainless steel, niobium–1% zirconium, molybdenum, vanadium, tantalum, Inconel, A-286, L-605, graphite, and various types of beryllium. Significant differences in the ability of the various materials to resist dimple, spall, and perforation were observed in both flat plate and tubular configurations. The unique behavior of materials subjected to high-velocity impacts is clearly demonstrated. Author

N66-14782*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
VIBRATION AND ACOUSTIC ANALYSES, SATURN SA-10 FLIGHT
8 Dec. 1965 100 p
(NASA-TM-X-53366) CFSTI: HC $4.00/MF $0.75 CSCL 20K

This report presents an analysis of the vibration and acoustic data measured during the flight of SA-10. Instrumentation and equipment used in the data acquisition and data reduction systems are described. The effects of the vibration and acoustic environment on the Saturn S-I stage, Instrument Unit, and Pegasus structure are evaluated. Structural response is described and presented pictorially in terms of power spectral density versus frequency. Internal Saturn SA-10 acoustic environments are discussed in terms of sound pressure spectrum level versus frequency. Installation sketches of all vibration and acoustic transducers used on the SA-10 flight vehicle are shown. Author

N66-14815# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
BOUNDS TO EIGENVALUES OF RHOMBICAL MEMBRANES
James T. Stadter 12 May 1964 52 p refs
(Contract NOw-62-0604-c)
(CF-3084; AD-622482)

Upper and lower bounds to eigenvalues are obtained for vibrating rhombical membranes. Two specific problems are treated: the membrane which has all edges fixed and the membrane which has two opposite edges fixed, the other two edges free. These problems have been studied as part of a systematic program for the development of rigorous methods for the estimation of frequencies of elastic structures. The techniques used are applicable to a substantial class of plate problems of interest in guided missile technology, but, since the analysis for membranes is in general easier than for plates, the problems treated here form an ideal vehicle for the acquisition of experience in applying the methods (actually, the fixed membrane problem considered here is essentially identical with the problem for simply supported plates. The method used consists of the following steps: (1) map the rhombus to the unit square using an affine transformation; (2) obtain the quadratic form, J, of the transformed membrane operator; (3) introduce two quadratic forms, one smaller than J, one larger, for which the corresponding eigenvalue problems can be solved; and (4) apply the B*B method to obtain the desired bounds. TAB

N66-14909*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISON OF FULL-SCALE AND MODEL BUFFET RESPONSE OF APOLLO BOILERPLATE SERVICE MODULE
Robert V. Doggett, Jr. Washington, NASA, Jan. 1966 13 p refs
(NASA-TM-X-1202) CFSTI: HC $1.00/MF $0.50 CSCL 20K

Some preliminary results are presented to compare the high-frequency local buffet responses obtained in the actual flight of the Saturn-Apollo 7 with the responses predicted by an aeroelastic-model technique for the boilerplate Apollo service module. Data are presented in the Mach number range from 0.30 to 1.30. Although some disparities are noted in the data, the general results indicate that the use of aeroelastic models as tools to predict high-frequency local buffet response of full-scale structures is a promising technique. Author

N66-14913*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PRELIMINARY THERMAL DISTORTION ANALYSIS OF THE PROPOSED AOSO EXPERIMENT SUPPORT STRUCTURE
Donald E. Gray Sep. 1965 38 p refs
(X-430-65-493; NASA-TM-X-55380) CFSTI: HC $2.00/MF $0.50 CSCL 20K

A mathematical model of one experiment ideally mounted to the experiment support tube is considered. A set of compatibility equations is developed and expanded to determine expressions for interaction loads and rotational deflections. Two digital computer programs are developed to undertake a host of thermal inputs for various experiment sizes and mounting locations. Author

N66-15021# David Taylor Model Basin, Washington, D. C. Acoustics and Vibration Lab.
RUDDER-HULL VIBRATION AND FLUTTER ANALYSIS OF A HIGH-SPEED SHIP (PGM MOTOR GUNBOAT)
Ralph C. Leibowitz Oct. 1965 224 p refs
(DTMB-1993; AD-622562) CFSTI: HC $6.00/MF $1.25

This report presents the results of a 'flutter' analysis for a PGM Motor Gunboat. The results were obtained both by computing the rudder-hull vibrations (including flutter) on an analog computer and by numerical analysis. The analogs are based upon extensions of previously derived theories and methods for representing the vibrating system excited by hydrodynamic forces and for evaluating the rudder-hull structural and hydroelastic parameters and hydrodynamic parameters referenced in this report. The results indicate that (assuming a minimum conceivable value of damping) for the PSM rudder-hull system, control surface flutter will occur at approximately 90 knots. Moreover, the flutter characteristics of the entire rudder-hull system are more complex than classical flutter of simpler systems involving two vibration modes; hence conclusions concerning the classical or binary flutter of a two- or three-degree-of-freedom rudder do not apply to the entire rudder-hull combination. Author (TAB)

N66-15080# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
A TEST APPARATUS AND PROFILE MEASUREMENT SYSTEM FOR RECTANGULAR PLATES SUBJECTED TO IN PLANE THRUSTS
J. Swota, Jr. and S. H. Miller 10 May 1965 14 p
(Contract W-31-109-ENG-52)
(KAPL-M-6493) CFSTI: HC $1.00/MF $0.50

Test apparatus designed and constructed to procure information on structural stability of rectangular plates subjected to in-plane thrusts is discussed in some detail. To illustrate the use of the apparatus and the information it can provide, sketches of the equipment components are presented along with typical data obtained for an 1100-0 aluminum plate material. Author (NSA)

N66-15104# Catholic Univ. of America, Washington, D. C. Stress Analysis Lab.
STRESSES IN A SQUARE SLAB BONDED ON ONE FACE TO A RIGID PLATE AND SHRUNK Interim Report

A. J. Durelli, V. J. Parks, and C. J. del Rio Nov. 1965 23 p refs
(Contract Nonr-2249(06))
(IR-8; ONR-630; AD-474272)

A square epoxy slab 14 in. × 14 in. × 1 in. was bonded to a rigid plate on one of its faces. In the process of freezing photoelastic effects a state of restrained shrinkage developed. Slices removed from the slab were used to determine the stress. Author (TAB)

N66-15175*# Martin Co., Denver, Colo.
COMPILATION OF SHOCK, VIBRATION, AND ACOUSTIC DATA FROM TITAN VEHICLES. VOLUME III: TITAN II SHOCK, VIBRATION, AND ACOUSTIC DATA
Jan. 1965 399 p
(Contract NAS1-4312)
(NASA-CR-62002; CR-64-86(Vol. III)) CFSTI: HC $7.00/MF $2.00 CSCL 20K

Results of vibration, acoustic, and shock data obtained by Titan II are presented in tabular form. Measurement descriptions and locations of vibration transducers are included, and power spectral density plots are presented in several hundred graphs. The location of acoustic measurements and the resultant overall sound pressure levels are summarized, with probability levels given for each compartment for each firing configuration. Shock data is given for laboratory tests, for Stage I captive firings, and for Stage II flight. M.W.R.

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N66-14337 Aeronautical Research Council (Gt. Brit.)
PART I: THE COOLING PERFORMANCE OF A SET OF EXTRUDED AIR-COOLED TURBINE BLADES
D. E. Fray and J. F. Barnes *In its* An Exptl. High-Temp. Turbine 1965 p 1-27 refs (See N66-14336 05-01) Supersedes NGTE-R-249; ARC-24565 HMSO: £ 1
(NGTE-R249; ARC-24565)

Cooling characteristics are given in terms of the variation of average blade temperature at mid-span with cooling-flow rate, Reynolds number, gas/cooling-air absolute temperature ratio, and, for the rotor, gas-stream incidence. Chordwise and spanwise variations of blade temperature are also presented. Measured pressure-drop characteristics indicate that in a gas-turbine engine, with the cooling-air inlet pressure equal to the turbine gas inlet total pressure, cooling flows roughly equal to 1.8 percent and 3.0 percent of the main gas flow could be passed through the nozzle and rotor blades respectively, giving average relative temperatures at mid-span of approximately 0.6 in each instance. Comparisons with theoretical estimates of blade temperature show that the external heat-transfer rates to the nozzle blades agreed well with those measured on similar blades in cascade tests. For the rotor blades the external heat-transfer rates appear to have been between those predicted from cascade and earlier turbine test data. From the measured effects of Reynolds number on blade temperature it seems that approximately equal areas of laminar and turbulent boundary layer existed on both nozzle and rotor blades, and that as the turbine inlet temperature was raised, the extent of the turbulent layer tended to increase. Author

N66-14364# European Atomic Energy Community, Brussels (Belgium).
STUDY OF CIRCUMFERENTIAL AND AXIAL TEMPERATURE PERTURBATIONS IN A CYLINDRICAL FUEL ELEMENT CANNING (MATHEMATICAL AND RHEOANALOGICAL METHODS) [ETUDE DES PERTURBATIONS CIRCONFERENTIELLES ET AXIALES DE TEMPERATURE DANS UNE GAINE CYLINDRIQUE D'ELEMENT COMBUSTIBLE (METHODES MATHEMATIQUE ET RHEOANALOGIQUE)]
E. Aranvitch, E. Labarre, and J. Reynen 1965 78 p refs In FRENCH; ENGLISH summary
(EUR-2480.f) CFSTI: HC $3.00/MF $0.75

The effect on the local canning temperature of circumferential perturbations in the fuel heat generation, the heat transfer coefficients between fuel and canning on one side and between canning and fluid on the other side have been studied mathematically by the decomposition of the perturbations into Fourier-Series. Several numerical cases are considered. Rheoanalogical methods based either on a conductive paper or on resistance networks are used to study the perturbations resulting from local insulated zones in a canning, and from fuel pellets in an eccentric position. The temperature distribution in a fuel element extremity has been studied by the method of resistance networks. Author

N66-14369# General Applied Science Labs., Inc., Westbury, N. Y.
DESCRIPTION OF AN IBM 7090 PROGRAM FOR THE CALCULATION OF TRANSIENT TEMPERATURE DISTRIBUTION IN AN ANISOTROPIC NONHOMOGENEOUS SHELL OF REVOLUTION WITH ARBITRARY HEAT FLUX AT ONE BOUNDARY FOR A PERFECT GAS
Burton Bellow 30 Sep. 1965 11 p
(TR-287, Suppl. 1)

A revision is presented for the heat flux subroutine for a perfect gas, one of four options on an IBM 7090 computer program for calculation of transient temperature distribution in a generalized shell of revolution having graded anisotropic properties. Modifications described permit the use of the perfect gas relationships. Various aerodynamic properties along the trajectory are required for the specification of heat flux. M.W.R.

N66-14379*# National Aeronautics and Space Administration, Washington, D. C.
SURVEY ON PROBLEMS IN THE FIELD OF NUCLEATE BOILING AND FILM BOILING [GRUNDZUGE DER PROBLEME AUF DEM GEBIET DER BLASEN- UND FILMVERDAMPFUNG]
H. Herkenrath and P. Moerk-Moerkenstein Dec. 1965 59 p refs Transl. into ENGLISH of EURATOM rept. EUR-2211.d, Brussels, Dec. 1964
(NASA-TT-F-9809; EUR-211.D) CFSTI: HC $3.00/MF $0.50 CSCL 20M

A survey of the research in the field of nucleate boiling and film boiling is given. A clear distinction is made between the processes occurring in pool boiling and forced convection boiling. The various kinds of flow patterns associated with the boiling process are discussed in detail. A summary is presented of the most important empirical and theoretical relations for the critical heat flux. Author

N66-14384*# National Aeronautics and Space Administration, Washington, D.C.

EXPERIMENTAL AND THEORETICAL RESULTS ON HEAT TRANSFER AT THE LEADING EDGE OF HYPERSONIC SWEPTBACK WINGS [RESULTATS EXPERIMENTAUX ET THEORETIQUES SUR LE TRANSFERT DE CHALEUR AU BORD D'ATTAQUE DES AILES A FORTE FLECHE EN HYPERSONIQUE]

J. Valensi, R. Michel, and D. Guffroy Jan. 1966 27 p refs Transl. into ENGLISH from the publ. "Recent Developments in Boundary Layer Research, Part 2" AGARD, May 1965 p 889–907

(NASA-TT-F-9871) CFSTI: HC $2.00/MF $0.50 CSCL 20M

This paper is devoted to a survey of the theoretical and experimental results on laminar heat transfer at the leading edge of hypersonic wings. The results of pressure and transfer heat rate measurements at the stagnation line of leading edges at Mach numbers 4, 7, and 10 are presented. Two techniques of theoretical analysis are described and illustrated; they are based on the solution of the local and global boundary layer equations respectively. The theoretical and experimental results are in satisfactory agreement in the case of large sweep angle but the effect of a strong entropy gradient due to the curvature of the shock wave is evident in the case of medium sweep at high speed. Author

N66-14389*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THERMOPOTENTIAL MEASUREMENTS OF ALKALI HALIDES

Jacob Greenberg Washington, NASA, Jan. 1966 99 p refs Presented at the Electrochem. Soc. Meeting, San Francisco, 5–9 May 1965

(NASA-TN-D-3179) CFSTI: HC $1.00/MF $0.50 CSCL 20M

It has been found that when sodium iodide, potassium iodide, cesium chloride, sodium chloride, and potassium chloride are subjected to thermal gradients, Seebeck coefficients are obtained that vary as a function of the salt and the average temperature. The Seebeck coefficients were found to increase, to reach a maximum of 2 to 3 millivolts per °C, and then to decrease as the temperature was increased. This was usually found to occur within 100° C on either side of the melting point. It was possible to maintain a steady external flow of current of several milliamperes from the thermopotential developed in the cesium chloride cell. At lower temperatures, it appears that cation migration is primarily responsible for the thermopotential, while at higher temperatures the thermopotential appears to be due to the anion migration. Author

N66-14399# Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.

HIGH-TEMPERATURE, EQUILIBRIUM THERMODYNAMIC PROPERTIES OF CHEMICALLY REACTING MIXTURE OF N_2, O_2, CO_2, AND Ne

Philip Adams Nov. 1965 43 p refs *Its* Rept.-2 (SSD-50065R)

This report describes various computer programs which have been developed to deal with the equilibrium thermodynamic and flow properties of a reacting gas mixture, under conditions associated with hypersonic flight. The mixture considered is, when cold, composed of arbitrary proportions of N_2, O_2, CO_2, A, and Ne. At high temperatures, as many as 29 species are considered. Author

N66-14402# Michigan Univ., Ann Arbor. Liquid Metal Lab.

INVESTIGATION OF LIQUID METAL BOILING HEAT TRANSFER Progress Report, May–Aug. 1965

Bruce F. Caswell, Andrew Padilla, Jr., Herman Marte, Jr., Robert E. Barry, and Robert L. Gahman Aug. 1965 48 p refs (Contract AF 33(657)-11548)

(Rept.-05750-23-P; AD-622825) CFSTI: HC $2.00/MF $0.50

Critical heat flux determinations with rubidium continued. Burnout results along with other liquid metal burnout data were correlated with a dimensionless relation. A film boiler yielded data over pressure range of 2–19mm mercury. The data falls slightly above the predictions of Berenson for potassium film boiling at a pressure of a 0.1 atm. Data obtained for which the surface temperature exceeded the saturation temperature by greater than 700F yielded reasonably consistent results when the flux was calculated by two independent procedures. At lower values of the surface temperature, unusual behavior was encountered which is probably related to transitional effects which began to occur on the wall of the vessel near the boiling plate. A forced circulation apparatus was operated to yield condensing coefficients for sodium over a temperature range of 1240F to 1525F and a range of heat fluxes from 215,000 to 583,000 BTU/(hr.) (Sq. ft.). The condensing coefficient was observed to be essentially constant over these ranges at a value of 10,800±3,300 BTU/hr.) (sq. ft.) (F). TAB

N66-14448# Deutsche Versuchsanstalt für Luft-und Raumfahrt, Freiburg (West Germany).

PERFORMANCE OF HEAT PROTECTION AT HYPERSONIC FLIGHT SPEEDS [DAS VERHALTEN VON WARMESCHUTZSCHILDEN BEI HYPERSONISCHEN FLUGGESCHWINDIGKEITEN]

E. Adams Oct. 1965 94 p refs In GERMAN, ENGLISH summary

(DLR-FB-65-48) CFSTI: HC $3.00/MF $0.75

Owing to the strong interactions between hypersonic air flows and aerodynamic heat protection systems, two introductory parts treat flight mechanics of trajectories descending in atmospheres, and aerodynamic heating. In part 3, the applicability of metal surfaces is discussed, and, in particular, the performance of ablation-type materials and shields. Part 4 is concerned with the hypersonic aerothermochemistry of evaporating or sublimating surfaces, i.e., one of the most important regimes of current research work on ablation-type heat protection. Author

N66-14456# Rocketdyne, Canoga Park, Calif.

STEADY-STATE ROCKET COMBUSTION OF GASEOUS HYDROGEN AND LIQUID OXYGEN. PART II: ANALYSIS FOR COAXIAL JET INJECTION

L. P. Combs and M. D. Schuman Mar. 1965 141 p refs (Contract AF 49(638)-817)

(RR-64-29; AFOSR-65-1319; AD-623401) CFSTI: HC $4.00/MF $1.00

Simultaneous equations describing rocket propellant injection, atomization, mixing, vaporization, and combustion are formulated for a cylindrical liquid oxygen jet surrounded by an annual gaseous hydrogen stream. The formulation is based on division of the combustion chamber into a non-burning region near the injector and a combustion region further downstream. Processes in the non-burning region are required to satisfy certain combustibility criteria before combustion is possible. The propellants then pass through a plane flame front into the combustion region. A simplified treatment of turbulent mixing between unlike reacting gas streams, one of which contains a liquid oxygen spray, characterizes the combustion region model. Solutions of the system of equations, obtained with a digital computer program, are detailed, discussed, and compared favorably with experimental information from Part I. Author (TAB)

N66-14506# Illinois Univ., Urbana.
CALORIMETRIC INVESTIGATION OF GAS ENTERING THE NOZZLE OF A LOW-DENSITY HIGH-VELOCITY WIND TUNNEL
Ronald George Barth (M.S. Thesis) 1965 39 p refs
(Contract AF 33(608)-1069)
(AD-620457) CFSTI: HC $2.00/MF $0.50

The impetus for conducting a calorimetric investigation of an arc-heater generated flow entering the diverging section of a supersonic nozzle was initiated by construction, at the University of Illinois, of a low-density, hypervelocity wind tunnel, consisting of an arc-heater, stilling chamber, supersonic nozzle, test chamber, adjustable diffuser, and a steam-ejector vacuum pump. All major components of the tunnel were tested separately. A total calorimeter was designed and built to establish by direct measurement the stagnation enthalpy at the nozzle throat. TAB

N66-14515# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FLOWS OF GAS WITH IGNITION BEHIND A SHOCK WAVE
R. I. Soloukhin 30 Aug. 1965 19 p refs Transl. into ENGLISH from Probl. Energ. Sb. Akad. Nauk SSSR, Energ. Inst. (Moscow), 1959 p 735–744
(FTD-MT-64-523; AD-621770) CFSTI: HC $1.00/MF $0.50

Consideration is given to the state of a gas behind a shock wave propagating in a gas mixture capable of chemical reaction. A description is given of the phenomenon of spinning detonation as a result of instability of the supercompressed detonational wave, which leads to the onset of oscillations. TAB

N66-14564# Applied Physics Lab., John Hopkins Univ., Silver Spring, Md.
SATELLITE BOOST PHASE HEATING
R. M. Vernon 12 Mar. 1964 54 p refs
(Contract NOw-62-0604-c)
(CF-3076; AD-622484) CFSTI: HC $3.00/MF $0.50

An analytical and experimental study of boost phase heating of satellite 1963 22A has been accomplished. Two stages of heating were considered: (1) Radiative and convective heat transfer between heat shield and payload, and (2) Direct aerodynamic heating after heat shield ejection. The results show that a maximum temperature rise possible on any portion of the payload is 38° F before heat shield ejection and about 240° F after heat shield ejection. However, the latter temperature rise is highly localized and the associated heat input is easily accommodated by the payload without any perceptible overall temperature increase. It was concluded that, for the contemplated boost trajectory, no serious heating of the satellite would be encountered. Author (TAB)

N66-14611# Library of Congress, Washington, D. C. Aerospace Technology Div.
THE THEORY OF DETONATION, THE COMBUSTION MECHANISM AND THE PROPERTIES OF EXPLOSIVES Surveys of Soviet Scientific and Technical Literature
Seraphim Parandjuk 8 Dec. 1965 46 p refs Compilation of abstracts
(ATD-66-111)

Abstracts are presented on articles in the Soviet open literature dealing with the theory of combustion, the mechanism of combustion, and the properties of explosions. A total of fifty abstracts are included. E.E.B.

N66-14686# Bureau of Mines, Berkeley, Calif.
HIGH-TEMPERATURE HEAT CONTENTS AND ENTROPIES OF TWO ZINC SULFIDES AND FOUR SOLID SOLUTIONS OF ZINC AND IRON SULFIDES
L. B. Pankratz and E. G. King [1965] 16 p refs
(BM-RI-6708)

Heat contents, measured above 298.15° K, and derived entropy increments are presented in tabular and equation form for the two crystalline forms of zinc sulfide (sphalerite and wurtzite) and for four solid solutions of iron and zinc sulfides. Author

N66-14767*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
THERMAL EMITTANCE BEHAVIOR OF SMALL CAVITIES LOCATED ON REFRACTORY METAL SURFACES
J. Robert Branstetter and Robert D. Schaal Washington, NASA, 1965 15 p refs Presented at the Thermionic Conversion Specialists Conf., sponsored by IEEE, San Diego, Calif., 25–27 Oct. 1965
(NASA-TM-X-52147) CFSTI: HC $1.00/MF $0.50 CSCL 20M

The emittance of small cavities electrically disintegrated in tungsten and molybdenum is measured with a disappearing-filament pyrometer. Cones and cylinders are studied. If proper safeguards are taken, cavities such as these are reliable targets on which to sight pyrometers when metal surface temperature is desired. The fabrication method yields cavities of satisfactory reproducibility. The emittance results are compared with analytical expressions and the latter are shown to be of very limited value except for deep, isothermal cavities. Author

N66-14768*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
POTASSIUM CONDENSING TESTS OF HORIZONTAL MULTITUBE CONVECTIVE AND RADIATIVE CONDENSERS OPERATING AT VAPOR TEMPERATURES OF 1250° TO 1500° F
O. A. Gutierrez, N. J. Sekas, L. W. Acker, and D. B. Fenn Washington, NASA, 1965 28 p refs Presented at the Rankine Cycle Space Power System Specialists Conf., sponsored by AIAA, Cleveland, 26–28 Oct. 1965
(NASA-TM-X-52148) CFSTI: HC $2.00/MF $0.50 CSCL 20M

Two types of horizontally oriented multitube vapor condensers, dissipating heat loads up to 150 KW thermal, were tested over a range of vapor temperatures from 1250° to 1500° F. One condenser was a 7-tube counterflow shell-and-tube type convective heat exchanger, condensing potassium vapor inside the tubes and using NaK 78 as the shell side coolant. The other unit was a radiative type condenser, consisting of 9 coplanar, parallel-finned tubes manifolded to common inlet and outlet headers. This unit was tested inside an oil-cooled chamber in a vacuum environment of 3×10^{-3} torr. The objective of the tests was to study the performance and operating problems associated with current state-of-the-art units at near realistic operating conditions. It appears from these tests that it is possible to operate either type of multitube condenser in a stable manner over a large range of operating conditions. The advisability of using cocurrent coolant flow at the vapor inlet end of convective condensers is indicated, and the importance of properly evaluating inlet pressure drops is also pointed out by the results. Author

N66-14771*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
AN EXPERIMENTAL STUDY OF THE CONDENSING CHARACTERISTICS OF MERCURY VAPOR FLOWING IN SINGLE TUBES

James A. Albers and David Namkoong, Jr. Washington, NASA, 1965 35 p refs Presented at the Rankine Cycle Specialists Conf., sponsored by AIAA, Cleveland, 26–28 Oct. 1965 (NASA-TM-X-52151) CFSTI: HC $2.00/MF $0.50 CSCL 20M

An investigation was conducted to determine the condensing characteristics of mercury vapor flowing in horizontal single tubes. For a crossflow-nitrogen-cooled condenser, flow regime and pressure drop were investigated for nonwetted flow in constant diameter and tapered tubes under 1 and 0 g, and for wetted flow in tapered tubes under 1 g. For a counterflow-NaK-cooled condenser, heat transfer, inlet pressure, and pressure drop were investigated for a tapered tube under 1 g. Within the limits of the investigation and predicted on SNAP-8 requirements, the results obtained from the nitrogen-cooled condenser indicated no significant influence of gravity on nonwetted condensing pressure drop. Wetted 1-g condensing frictional pressure drop was higher than that of nonwetted only at the higher flow rates in a tapered tube. Data compared with the Lockhart-Martinelli and fog-flow correlations showed deviation from the former and data scatter on the latter. Author

N66-14781*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

A SET OF EXPERIMENTS IN THERMAL SIMILITUDE

Billy P. Jones and James K. Harrison 18 Oct. 1965 70 p refs (NASA-TM-X-53346) CFSTI: HC $3.00/MF $0.75 CSCL 20M

The analysis and results for two sets of experiments in thermal scale modeling are presented. The prototype and model consist of a plate, cylinder, and sphere exchanging thermal energy by radiation only. They were located relative to one another in an unsymmetrical arrangement. The experimental results generally confirm the modeling rules, with some exceptions in the details, due largely to an a priori assumption made regarding the volume partitioning of the objects to be modeled. Author

N66-14850# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

THERMODYNAMIC AND COMPOSITION DATA FOR CONSTANT-VOLUME COMBUSTION OF STOICHIOMETRIC MIXTURES OF HYDROGEN-OXYGEN DILUTED WITH HELIUM OR HYDROGEN

Andre Benoit and John Galipeau Wright-Patterson AFB, Ohio, ARL, Aug. 1965 216 p refs

(Contract AF 33(657)-7874)

(ARL-65-174; AD-623942) CFSTI: HC $6.00/MF $1.25

The equilibrium thermodynamic properties of the burned gases resulting from complete combustion at constant volume of a hydrogen-oxygen stoichiometric mixture diluted with an excess of hydrogen or helium have been computed for a wide range of initial pressures (from 1 to 10,000 atmospheres), assuming no dissipative effects. For the initial mixtures represented by the formula $(2 + M)\ H_2 + O_2 + NHE$, A computer program written in FORTRAN II for a 7090 IBM computer was utilized, and was convenient for the computation of the post-combustion properties for any set of values of M and N within the ranges $0 < or = M < or = 6$ and $0 < or = N < or = 16$. The problem leads to a complete system of nine algebraic non-linear equations. Outputs are provided for the following quantities: final temperature and final-to-initial temperature ratio, final pressure and final-to-initial pressure ratio, final molecular weight, specific heat at constant pressure of the frozen composition combustion products, frozen composition specific heat ratio of the combustion products, final frozen composition speed of sound, final-to-initial speed of sound ratio, number of moles in burned gases per mole of oxygen in initial mixture, final-to-initial mole number ratio, molar concentration of H_2O, OH, H_2, O_2, H, O and He in the burned gases. TAB

N66-14882# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

PROBLEMS IN ABLATION Technical Report No. 13

L. Bourély May 1965 36 p refs

(Contract Nonr-225(30))

(SUDAER-233; AD-622567) CFSTI: HC $2.00/MF $0.50

The velocities of particles of a viscous solid on the free surface of an ablative body submitted to hypersonic re-entry conditions are analytically determined. The viscosity of the liquid formed during the ablative process is considered to be constant. The problem is treated with the aid of Hankel transforms for a semi-infinite flat body submitted to normal pressure and skin friction on its plane boundary. A viscous liquid layer uniformly spread on a solid sphere is also considered and the solution is given in the form of a Fourier series with the boundary conditions represented approximately. Author (TAB)

N66-14890 Library of Congress., Washington, D. C. Aerospace Technology Div.

COMBUSTION STABILITY OF SPHERICAL FLAMES

Paul Vantoch *In its* Foreign Sci. Bull., Vol. 1, No. 12 Dec. 1965 p 12–14 refs (See N66-14887 05-34)

Analysis of two recently published sources indicates that spherical-flame studies may provide clues to the mechanism and the driving forces of combustion instability. According to the theory discussed, spherical flames of small diameter exhibit improved combustion stability and their use may offer some advantages in combustors. Author

N66-14943# Naval Research Lab., Washington, D. C.

A STUDY OF THE IONIZATION PRODUCED BY THE CATALYTIC COMBUSTION OF HYDROCARBONS

F. J. Woods, M. E. Umstead, and J. E. Johnson 1 Oct. 1965 18 p refs

(NRL-6316; AD-623014) CFSTI: HC $1.00/MF $0.50

Ionization produced during the catalytic combustion of hydrocarbons was studied for its usefulness in applications such as chromatographic detection. When a platinum filament is heated above 500° C in an atmosphere containing the hydrocarbon, the formation of ions takes place during oxidation of the compound. The number of ions produced by the hydrocarbons is an exceedingly small fraction of the number of carbon atoms oxidized and varies widely depending upon the molecular structure of the hydrocarbon and the catalyst temperature. Branched hydrocarbons produce greater ionization than straight-chain compounds, although the ease of oxidation is opposite. Hydrogen and carbon monoxide burned in the combustion cell exhibit no ionization current, even when completely oxidized. Because of the marked effect of molecular structure on ionization and the response of the method to low concentrations of hydrocarbons in air, the procedure may find future use as a specific detector in gas chromatography. Author (TAB)

N66-15000# Library of Congress, Washington, D. C. Aerospace Technology Div.

SOME ASPECTS OF COMBUSTION KINETICS Surveys of Soviet-Bloc Scientific and Technical Literature

Victor Seemann 6 Dec. 1965 148 p refs Compilation of abstracts *Its* Rept.-1

(ATD-P-65-100)

Abstracts and translations of recent material pertaining to the kinetics of supersonic combustion are presented. A general analysis of the subject areas discussed, which include gas combustion behind shock waves, shock wave propagation, flow

velocities, detonation, stabilization, and free radical recombination, is given. An author index to the above abstracts is given, and an additional compilation of abstracts in the subject area compiled from the Aerospace Technology Division press of the Library of Congress is also given. L.S.

N66-15120# SAAB Aircraft Co., Linkoping (Sweden).
CALCULATION OF TEMPERATURE IN AN INFINITE WEDGE WITH GIVEN HEAT FLUX THROUGH ITS BOUNDING SURFACES
Bert Arlinger Aug. 1965 35 p refs
(SAAB-TN-59) CFSTI: HC $2.00/MF $0.50

In an infinite wedge the exact distribution of temperature has been calculated with given heat flow through the bounding surfaces. Use has been made of Green's function and the solutions have been studied for a heat flux q through the boundaries which is of the type $q \sim r^{-1}$, where r is polar distance from the edge and $1 (> -1)$ a constant. The solution is especially simple for constant q (i.e. $1 = 0$), and this solution can be interpreted in an intuitive physical way. Special attention has been paid to the distribution of temperature in thin wedges, and the limiting case of constant temperature on the cross section has been studied. One studies also the "contrary" limiting case that the wedge under certain conditions can be substituted by a semi-infinite body. Amongst other things diagrams are given showing the parameter regimes in which these limiting cases give good approximations to the exact distribution of temperature. Author

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N66-14419*# Stanford Univ., Calif. School of Engineering.
A STUDY OF THE UNIVERSITY ROLE IN ENGINEERING RESEARCH FOR NASA PARTICULARIZED TO THE STANFORD UNIVERSITY CASE Final Report
25 Jun. 1965 136 p refs
(Grant NGR-05-020-069)
(NASA-CR-68968) CFSTI: HC $4.00/MF $1.00 CSCL 05I

A study report is given on the university role in engineering research, and an examination of research practices, program character, attitudes of the faculty and students, and the administrative problems in carrying out a NASA program in a particular school of engineering. Although the study was made in the context of the Stanford University engineering community, other inputs were used, and many of the results are believed to have a general applicability to NASA-University relations. In the course of the study detailed quantitative information was accumulated through structured interviews with research-oriented engineering faculty members, and other less formal interviews with additional members of the faculty and with students. Detailed conclusions are given concerning engineering students and teaching; research and graduate education; character and organization of faculty research; university contributions to space flight projects; university-community interaction and spin-off; and NASA funding of university research. C.T.C.

N66-14434# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY NO. 250
1 Dec. 1965 108 p refs Transl. into ENGLISH from Chinese publ.
(JPRS-33099; TT-65-33676) CFSTI: $4.00

CONTENTS:

1. RELEASE OF ATOMIC ENERGY p 1–47
2. NUCLEAR WEAPONS AND DEFENSES AGAINST THEM p 47–72
3. SIXTEEN YEARS OF PROGRESS Szu-szu Hung p 73–76
4. THE APPROACH OF TRADITIONAL CHINESE MEDICINE TO CANCER—TREATMENT AND RESEARCH Kuo-liang Pai p 78–80
5. GUIDED MISSILE WARHEADS AND FUSES Ch'u-fei Li p 81–85
6. HOW TO PREVENT POISONING FROM ORGANIC PHOSPHORUS PESTICIDES Yung-hsiu Change p 96–89
7. RESEARCH ON ORGANOPHOSPHORUS COMPOUNDS Chun-ho Wu, Hsin-min Wang, and Hsiung-ming Sun p 90–95 refs
8. STUDIES ON ORGANOPHOSPHORUS COMPOUNDS Hsi-yen Lu and Kuo-Liang Wang p 96–106 refs

N66-14425# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY NO. 251
Fang-yun Chen et al 1 Dec. 1965 51 p refs Transl. into ENGLISH from Chinese periodicals
(JPRS-33121; TT-65-33698) CFSTI: $3.00

CONTENTS:

1. DEVELOPMENT OF ELECTRONIC TECHNOLOGY Fang-yun Chen p 1–16
2. EARNESTLY SUM UP EXPERIENCES TO FURTHER ENHANCE GRADUATION PLANNING WORK p 17–19
3. HIGHER POLYTECHNIC INSTITUTES HOLD FORUM ON GRADUATION PLANNING p 20–26
4. FIRST ALL-CHINA SUGAR CANE CONFERENCE HELD IN FOOCHOW Ying-lan Yang p 27–28
5. SALUTARY RESULTS OBTAINED IN PREVENTING COTTON DISEASES Yung-p'ing Chao p 29–30
6. REPUBLICATION OF *CHIEN-CHU HSUEH-PAO*. JOURNAL OF ARCHITECTURE p 31
7. SCIENCE PRESS PUBLISHED LIST OF 1966 PERIODICALS p 32–35
8. INVESTIGATION REPORT ON THE REVOLUTIONIZATION OF MEDICAL AND PUBLIC HEALTH WORK IN TIENTSIN p 36–43
9. SUCCESSFUL TESTING OF THE FU-HO DIESEL ENGINES IN TIENTSIN p 45–46
10. HOW WERE TWO NEW COMETS DISCOVERED? Shu-Ling Wei p 47–49

N66-14468# Naval Air Engineering Center, Philadelphia, Pa.
FOUNDATIONAL RESEARCH PROGRAM
1965 219 p refs
(AD-623630) CFSTI: HC $5.00/MF $1.25

Progress is reported on twenty-six research projects. These include the following: *Fluid Mechanics; Lubrication of Metal Surfaces with Solid Films; Oxygen Embrittlement of Metals; Aircraft Ejection Seat Design; Salt Water Permeation through Organic Protective Coatings; High Strength Aluminum Alloy Corrosion; Biological Stress; Maser Spectroscopy; Air Bubble Test Vehicle; Jet Noise Suppression; Polarization Studies of*

Corrosion; Polymer Chemistry; Electron Microfractography; Metabolic Mechanisms of Man; Deep-Sea Simulation; Turbines; Radiation; Thermoplastics; Neutron Activation Analysis; Synthetic Fibers; Heat Transfer; Catapult Operations; Missile Launching; and *Hydrogen Embrittlement of Metals and Alloys.* E.E.B.

N66-14577*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.
TIME ALLOCATION AMONG THREE TECHNICAL INFORMATION CHANNELS BY R AND D ENGINEERS
Thomas J. Allen and Maurice P. Andrien, Jr. Aug. 1965 23 p refs *Its* Rept.-131-65
(Grant NsG 235-62; NSF GN-233; NSF GN-353)
(NASA-CR-69091) CFSTI: HC $1.00/MF $0.50 CSCL 05B

Four government funded parallel research and development projects are examined to determine the manner in which engineers and scientists allocate their time, and the effect of this allocation on the outcome of the projects. The use of matched pairs of projects allows the relative evaluation of outcomes by technical monitors in the customer agencies. The percent of total time spent in three categories of information gathering (outside consultation, staff consultation, and literature search) varies significantly over the life of a project. Higher rated teams are relatively stable in all phases of information gathering while lower rated teams initially spend far more time gathering information than they do in the later stages and fluctuate more throughout the project. Subsystems characterized by greater uncertainty receive a higher percent of information gathering time than subsystems where uncertainty is lower. Author

N66-14872# Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS
Sep. 1965 48 p refs
(PB-168488)

CONTENTS:

1. SURFACE CHEMISTRY OF FLUOROCHEMICALS N. L. Jarvis and W. A. Zisman p 1–10 refs (See N66-14873 05-06)
2. IONOSPHERIC COMPOSITION AND DENSITY FROM 90 TO 1200 KILOMETERS AT SOLAR MINIMUM C. Y. Johnson p 11–14 refs (See N66-14874 05-13)
3. PROBLEM NOTES p 15–39 refs

N66-14887# Library of Congress, Washington, D. C. Aerospace Technology Div.
FOREIGN SCIENCE BULLETIN, VOLUME 1, NO. 12
Dec. 1965 68 p refs

CONTENTS:

1. THE PRIMARY COSMIC RAYS OF THE SUN AND THEIR DECOMPOSITION INTO SECONDARY COMPONENTS IN THE TERRESTRIAL ATMOSPHERE E. Gelins p 1–7 refs (See N66-14888 05-29)
2. OPTIMUM ACCELERATION OF A SPACECRAFT IN A CENTRAL FIELD L. Kacinskas p 8–11 refs (See N66-14889 05-30)
3. COMBUSTION STABILITY OF SPHERICAL FLAMES P. Vantoch p 12–14 refs (See N66-14890 05-33)
4. THEORY OF OPTIMAL ALLOYING D. Vvedensky p 15–18 refs (See N66-14891 05-17)
5. THE ENERGY OF BALL LIGHTNING A. Iwanovsky p 19–22 refs (See N66-14892 05-28)
6. SCIENTIFIC AND DOCUMENTATION ACTIVITIES IN THE SOVIET UNION S. Kassel p 23–30 refs (See N66-14893 05-34)
7. SCIENCE & TECHNOLOGY NOTES p 31–37
8. CONFERENCES p 38–47
9. SCIENCE PERSONALITIES p 48–51
10. BOOK REVIEWS p 52–57

N66-14893 Library of Congress, Washington, D. C. Aerospace Technology Div.
SCIENTIFIC AND DOCUMENTATION ACTIVITIES IN THE SOVIET UNION
Simon Kassel *In its* Foreign Sci. Bull., V. 1, No. 12 Dec. 1965 p 23–30 refs (See N66-14887 05-34)

A review of the state-of-the-art of Soviet scientific documentation is presented. The review, based on a comprehensive new publication by the agency responsible for documentation activities in the Soviet Union, includes discussion of the principles of scientific documentation, Soviet goals and achievements in this area, equipment used, etc. Author

N66-14917# Joint Publications Research Service, Washington, D. C.
MODELING OF THE PROCESS OF COMPILING SCHEDULES FOR URBAN PASSENGER TRANSPORT ON ELECTRONIC COMPUTERS
M. R. Kogalovskiy 15 Dec. 1965 32 p refs Transl. into ENGLISH from Ekon. i Mat. Metody (Moscow), no. 5, Sep.–Oct. 1965, p 718–729
(JPRS-33340; TT-65-33915) CFSTI: $2.00

The initial information used in compiling transportation schedules, and the structure of the modeling algorithm are examined. Individual schedules are compiled for each itinerary without coordination of intersecting routes, and data on the itinerary characteristics and its linkage with the yards serviced, and on the types and number of trains operating on the line and the work regime of the crews and trains are recorded on information cards. Methods for computing the various input elements are described. The procedures and relationships used in constructing the algorithm are considered, and the calculations are given. It is pointed out that the programming of the algorithm for compiling the schedule consists of about 15 000 commands stored on a magnetic drum, and that compilation of the schedule and the introduction of the initial information and printing of the result takes three to five minutes of computer time. M.G.J.

N66-14944# General Motors Corp., Indianapolis, Ind. Allison Div.
ALLISON RESEARCH AND ENGINEERING, VOLUME NO. 8, FOURTH QUARTER, 1965
1965 26 p refs

CONTENTS:

1. ANALYSIS AND TESTING OF AIR COOLED TURBINE ROTOR AND STATOR BLADES H. E. Helms and C. W. Emerson p 2–10 refs (See N66-14945 05-01)
2. REACTOR PHYSICS CALCULATIONS FOR THE GASEOUS CORE CAVITY REACTOR R. M. Kaufman, W. F. Osborn, Jr., J. R. Simmons, and E. B. Roth p 11–18 ref (See N66-14946 05-22)

N66-15037# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, No. 266

21 Dec. 1965 49 p refs Transl. into ENGLISH from Chinese periodicals
(JPRS-33433; TT-65-34007) CFSTI: $2.00

CONTENTS:

1. FIGHT SCHISTOSOMIASIS Yuan-hua Kuo and Ming-kang Ch'en p 1–6
2. PHOTO-ELECTRIC TRACING CUTTER Ku Yueh p 7–11
3. THE DEVELOPMENT OF MICROBIOLOGY S.-c. Teng p 12–19 (See N66-15038 05-04)
4. CONDITIONS FOR THE ADDITIVITY OF THE REFRACTIVE INDEX T.-n. Yeh p 20–28 refs (See N66-15039 05-13)
5. THE INFLUENCE OF THE PROPERTY OF COORDINATION POLYHEDRA OF COMPLEX ANIONS IN OXY-SALT ON THE DISTRIBUTION OF THE DOUBLE REFRACTIVE INDEX T.-n. Yeh p 29–34 refs (See N66-15040 05-13)
6. TWO NEW VARIETIES OF MINERALS OF THE SERPENTINE GROUP—FLUORANTIGORITE AND FLUOCHRYSOTILE P'o Wang and Wan-ch'un Lu p 35–40
7. ANNOTATED TABLE OF CONTENTS OF CHINESE COMMUNIST JOURNAL ON GEOGRAPHY p 41–42

N66-15042# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO. 253
6 Dec. 1965 75 p refs Transl. into ENGLISH from Chinese periodicals
(JPRS-33152; TT-65-33728) CFSTI: $3.00

CONTENTS:

1. MEDICAL FACILITIES THAT GUARD THE HEALTH OF SIX HUNDRED MILLION PEOPLE p 1–12
2. QUESTIONS AND ANSWERS ON COMMUNIST CHINA'S HEALTH INSURANCE p 13–16
3. RADIATION PROTECTION p 17–38 (See N66-15043 05-04)
4. POWER GENERATION BY SEA WAVES Mo p 39–40
5. OVERSEAS CHINESE UNIVERSITY IS DEVELOPING Chia-shen Yen p 41–43
6. ELECTROCHEMICAL STUDY ON CHEMICAL RATIO OF InSb L.-s. Yao and Y.-h. Tsou p 44–48 refs (See N66-15044 05-06)
7. OPTICAL MASER OF Nd^{3+} IN $CaWo_4$ S.-f. Liu, C. Hsi, P.-k. Liang, Y.-k. Huang, S.-y. Li et al p 49–54 refs (See N66-15045 05-26)
8. COUPLING WAVE THEORY OF GUIDE WAVE PROPAGATION IN FERRITE CYLINDER WITH VARYING CROSS SECTION H.-c. Huang and T.-y. Fan p 55–58 (See N66-15046 05-23)
9. RESEARCH ON MICROPHYSICAL MECHANISM OF RAIN FROM WARM CLOUDS Hsiu-chi Chou p 59–64

N66-15112# Catholic Univ. of America, Washington, D. C. Dept. of Electrical Engineering.
ELECTRICAL ENGINEERING RESEARCH REVIEW, NO. 4
Jun. 1965 102 p refs

CONTENTS:

1. THE COVARIANCE OF THE TEMPERATURE MICROSTRUCTURE IN TIME AND SPACE D. E. Sentarpia p 1–14 refs (See N66-15113 05-23)
2. ULTRASONIC STUDY OF CHROMIUM NEAR THE NEEL TEMPERATURE E. J. O'Brien and J. E. Franklin p 15–20 refs (See N66-15114 05-26)
3. PRECISION PHOTO-ELECTRONIC FUELMETER J. C. Michalowicz p 21–27 ref (See N66-15115 05-14)
4. DIELECTRIC RELAXATION IN PENTANEDIOL 1,5 F. M. Blake p 28–35 refs (See N66-15116 05-06)
5. AUTOCORRELATION TECHNIQUES APPLIED TO THE FETAL HEART SIGNAL A. G. Favret p 36–45 refs (See N66-15117 05-04)
6. MATCHED-FILTER PROCESSING OF FETAL ELECTROCARDIOGRAMS W. A. Welch p 46–56 (See N66-15118 05-04)
7. PHENOMENOLOGICAL THEORY OF POLARIZATION REVERSAL IN FERRIELECTRIC $Bi_4Ti_3O_{12}$ SINGLE CRYSTALS C. F. Pulvari and A. S. de la Paz p 57–86 refs (See N66-15119 05-26)

N66-15147# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO. 270
27 Dec. 1965 84 p refs Transl. into ENGLISH from Chinese
(JPRS-33486; TT-65-34060) CFSTI: $3.00

CONTENTS:

1. ATOMIC ENERGY AS A POWER SOURCE p 1–50 (See N66-15148 05-22)
2. PROBLEMS OF ATMOSPHERIC PROBES C.-c. Ku p 51–59 (See N66-15149 05-13)
3. ADVANCEMENT IN THE STUDY OF ORGANIC NITROGEN FIXATION Hsien-wu Chang p 60–74

N66-15151# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO. 274
5 Jan. 1966 70 p refs Transl. into ENGLISH from K'o-Hsueh T'ung-Pao (Peiping), no. 9, 20 Sep. 1965 p 753–759, 775–794, 805–810, and 831–832
(JPRS-33605; TT-66-30049) CFSTI: $3.00

CONTENTS:

1. THE DEVELOPMENT OF MOLECULAR BIOLOGY T.-c. Ts'ao and T.-p. Wang p 1–12 (See N66-15152 05-04)
2. THE DEVELOPMENT OF SEMICONDUCTORS S.-w. Wang p 13–16 (See N66-15153 05-26)
3. THE HYPOTHESIS OF THE ORIGIN OF THE EARTH C.-i. Fu p 17–22 refs (See N66-15154 05-13)
4. THE AGE OF THE EARTH W.-p. Weng p 23–30 refs (See N66-15155 05-13)
5. ENTOMOPHILIC MICROORGANISMS AND THEIR USES H. Tseng p 31–41 refs (See N66-15156 05-04)
6. PROGRESS IN SUPERSONIC DIAGNOSIS AND ITS EVALUATION Chih-chang Hsu p 42–50 refs
7. A NEW HIGH-TEMPERATURE POLAR FIXATOR: A STUDY OF FLUORINE ELASTOMERS J.-e. Chang, Y.-c. Ho, and I.-h. Sha p 51–57 refs (See N66-15157 05-06)
8. EFFECT OF IMMUNIZATION SERUM ON PHAGOCYTES, BACTERICIDINS, AND CELL METABOLISM T. Fang, H.-f. Wang, and M.-k. Su p 58–63 refs (See N66-15158 05-04)
9. A STUDY OF THREE VALENCE RARE EARTH OXIDES: BERYLLIUM OXIDE SYSTEM W.-l. Han and C.-k. Kuo p 64–67 refs (See N66-15159 05-06)
10. CHINESE TRADITIONAL MEDICINE AND WESTERN MEDICINE COOPERATE IN NEW TREATMENT FOR PHARYNGEAL DIPHTHERIA p 68–69

N66-15166# Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.

OPTIMAL ECONOMIC GROWTH AND WEALTH EFFECTS

Mordecai Kurz 18 Oct. 1965 21 p

(Contract Nonr-225(50))

(TR-136; AD-622871) CFSTI: HC $1.00/MF $0.50

The presence of wealth effects is shown to be a possible cause of the appearance of 'Saddle points' or multiple stationary solutions for the optimal path of economic growth. The importance of this fact is that it tends to narrow down the range of economic growth prescribed by the optimal path. This is so since starting from a fixed initial condition, and then having a multiplicity of stationary solutions may lead to the appearance of a relatively 'close' point towards which the optimal path converges. TAB

N66-15167# Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.

THE NONSUBSTITUTION AND NONSWITCHING THEOREMS IN A MODEL WITH FIXED CAPITAL

Eytan Sheshinski and Edwin Burmeister 20 Aug. 1965 28 p refs

(Contract Nonr-225(50)))

(TR-135; AD-622793) CFSTI: HC $2.00/MF $0.50

Let a competitive economy produce commodities of varying durabilities, such that (a) production processes exhibit constant returns to scale; (b) there is one exogenous nonproductible factor; (c) there are alternative techniques to produce each good; (d) it is possible to define conversion coefficients for old durable goods in terms of new goods of the same kind. Theorem: Let (A)–(d) hold. Then I: A long-run equilibrium of input-output coefficients and of prices in terms of wage units in uniquely determined for any preassigned value of the rate of interest. II: It is impossible to have identical techniques at different interest rates. This theorem generalizes Samuelson's static and dynamic nonsubstitution theorem. Author (TAB)

N66-15196# Joint Publications Research Service, Washington, D. C.

MATHEMATICAL FORMULATION OF A SIMPLIFIED MODEL OF PRODUCTION PLANNING

Yu. N. Tyurin 6 Jan. 1966 36 p refs Transl. into ENGLISH from Ekon. i Mat. Metody (Moscow), v. 1, no. 3, May/Jun. 1965 p 391–409

(JPRS-33613; TT-65-30057) CFSTI: $2.00

A production model is considered in which consumption during the planning period is given, and a production plan to satisfy this consumption is selected. A system of objectively conditioned evaluations of commodities and production capacities was studied. Commodity is the term used to describe everything produced by the economic system, and the amounts of commodities are measured in continuously changing quantities. Each individual enterprise or economic unit is described by its economic possibilities; that is, at identical expenditures of labor, power, raw materials, semi-finished products, etc., the same enterprise has the possibility of manufacturing different finished products. Each enterprise is put into relationship with a production map. The mathematical details and the concept of a differentiable map are given, and the conditions for the differentiability are formulated. The overall production possibilities of the entire economy are also described for a time period by the production map. The criteria of optimality are considered for the aims of the economy, and formulas are derived to define management by means of evaluation, and the income and outlay structure. M.G.J.

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New Jersey: Trenton
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—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

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CONTRACTOR REPORTS: Technical information generated in connection with a NASA contract or grant and released under NASA auspices.

TECHNICAL TRANSLATIONS: Information published in a foreign language considered to merit NASA distribution in English.

SPECIAL PUBLICATIONS: Information derived from or of value to NASA activities. Publications include conference proceedings, monographs, data compilations, handbooks, sourcebooks, and special bibliographies.

TECHNOLOGY UTILIZATION PUBLICATIONS: Information on technology used by NASA that may be of particular interest in commercial and other nonaerospace applications. Publications include Tech Briefs; Technology Utilization Reports and Notes; and Technology Surveys.

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